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Thomas A Edison Papers

A SELECTIVE MICROFILM EDITION

PART II
(1879–1886)

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1987

Thomas A. Edison Papers
at
Rutgers, The State University
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18 June 1981

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THOMAS A. EDISON PAPERS

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THOMAS A. EDISON PAPERS

A SELECTIVE MICROFILM EDITION
PART II
(1879-1886)

REEL 95

SPECIAL COLLECTIONS SERIES (SPC-6)

Charles Batchelor Collection
Scrapbooks [continued]

Francis R. Upton Collection

Charles Batchelor Scrapbook, Cat. 1243

This scrapbook covers the period October 1881-January 1882 and contains articles and illustrations relating to Edison's exhibit at the Paris Electrical Exhibition of 1881. Other clippings describe the Edison electric light and the construction of the Pearl Street central station in New York City. There is also a technical note by Edison pertaining to lamp improvements and an article by John W. Howell entitled "Economy of Electric Lighting by Incandescence." Some of the clippings are in French and German. The front cover is labeled "Oct 19th/81 No. 2." The spine is labeled "Oct to Dec 1881" and "1713 1964". The book contains approximately 200 unnumbered pages. The clippings are individually numbered 1713-1964.

FABRIQUE D'ENVELOPPES

1713 Presidential honours. Herald Oct 19

EDISON'S NUMEROUS PATENTS.

Mr. Edison has the reputation at the Patent Office of being the champion inventor. To-day, from the weekly announcements of patents issued, it appears that twenty-two have been granted to Mr. Edison during the past week. Twenty of these related to devices connected with the electric system of light, making a total of sixty patents now issued relating to this system of illumination. The clerks say that he has taken out more patents than any single inventor. He has to date been granted 209 patents, and has, according to the records, over one hundred more awaiting the decision of the Commissioner of Patents.

Engineering
Oct 25th 81

1714 All will be pleased to learn that a similar honour has been conferred upon Signor Pacinotti, of Cagliari, to whom is undoubtedly due the first conception of the Gramme ring and continuous armature, and whose exhibit is one of the most interesting historical objects in the Exhibition. To Mr. Edison, who exhibits in a large number of classes, and to whom not less than five juries recommended the awarding of a gold medal, the same recognition has been awarded, as well as to M. Baudot, Professor Graham Bell, Professor Bjerknes, of Christiania, whose beautiful hydro-dynamic experiments have constituted a special feature of interest in the Exhibition. To M. Marcel Deprey, to M. Gramme, to M. Gaston Planté, and to Dr. Werner Siemens, of Berlin, similar honours have been offered.

SKETCH ON P. 1716
copied by Lewis Studio
on 9/18/68.
NEG. # 6977.

1715 A.—A.— Herald — Oct 19

"MARKLAND ELECTRIC LIGHT AND POWER CO."

Incorporated under the Laws of the State of New York.

"NON-ASSESSABLE." "NO PERSONAL LIABILITY."

President—GILBERT L. HAIGHT.
Vice President—HORACE K. DILLINGHAM.
Treasurer—CHAS. MINZESHEIMER.
Secretary—C. JEROME FIQUET.

TRUSTEES:

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CHAS. MINZESHEIMER, THOMAS C. BUCK,
JOHN J. KIERNAN, GEORGE O. JONES,
HORACE K. DILLINGHAM.

We claim that W. H. Markland has discovered a new departure in electricity, and has produced a most wonderful Electric Lamp, for which he was granted a patent in August last, and which is now the property of this company.

The uniform steadiness of this lamp renders it immeasurably superior to every other illuminating process in existence. We direct particular attention to this distinguishing quality of "FREEDOM FROM FLUTTERING OR WAVERING, THE ONLY LIGHT POSSESSING THIS PROPERTY."

Baltimore, Philadelphia, Boston, &c., want auxiliary companies for their cities.

The stock from such companies would go in the treasury of this company.

A large resource of income will be derived from the manufacture of lamps under this patent, for use of hotels, theatres, manufactories and for street lighting.

The Edison and United States Electric Light stocks are selling at $1,000 and $100 per share, respectively, and we see no reason why the Stock of this company should not soon be in demand at a premium.

A limited number of shares are now offered for sale by subscription at $1 per share, as follows:—FIFTY CENTS payable on application; balance as called for by directors of the company.

Full paid stock delivered on payment of $1 per share.

Draw all checks to order of C. Minzesheimer, Treasurer.

Subscription books are now open at the following offices:—

WM. EUCLID YOUNG, 30 Broad st.
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JOHN J. KIERNAN, 2 Broad st.
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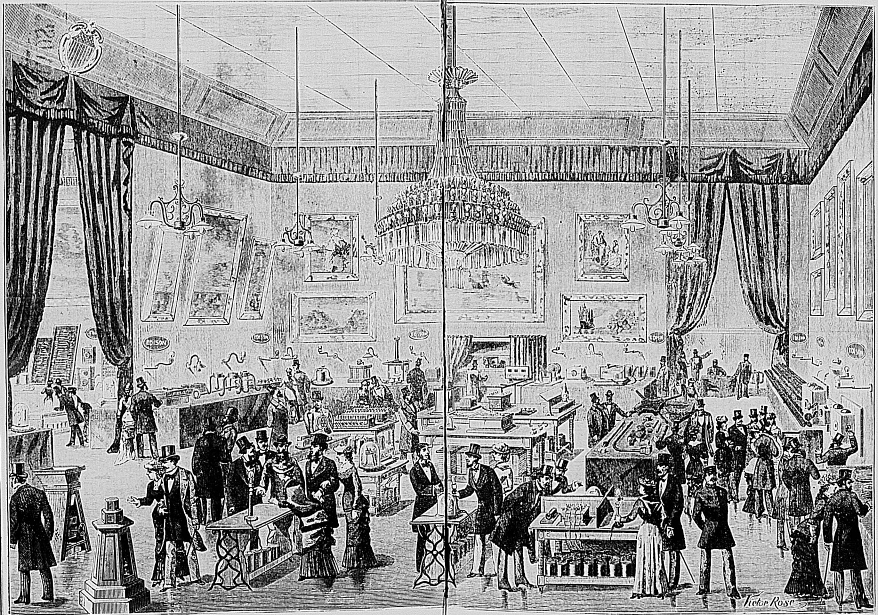
1716

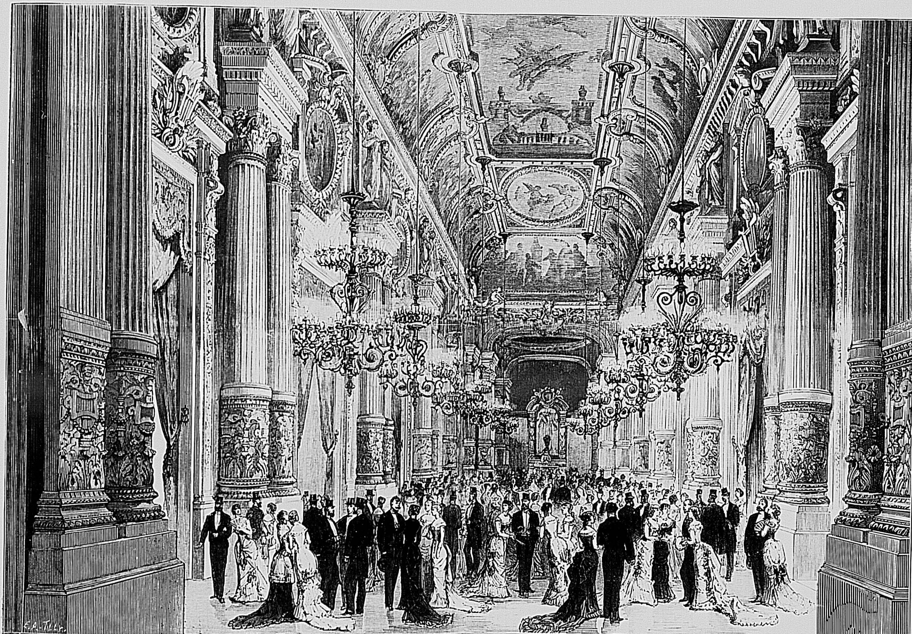
1716



L'EXPOSITION DE M. EDISON

PARIS. — L'EXPOSITION INTERNATIONALE D'ÉLECTRICITÉ AU PALAIS DE L'INDUSTRIE

1718



LE FOYER DE L'OPÉRA ÉCLAIRÉ A LA LUMIÈRE ÉLECTRIQUE (SYSTÈME EDISON)

LA ACADEMIA

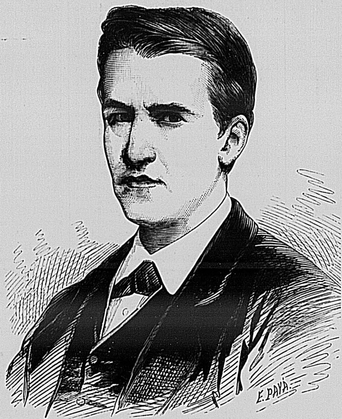
MADRID 30 DE OCTUBRE DE 1878

1719

THOMAS ALBA EDISON

El célebre genio, cuyo retrato lleva nuestra página primera, nació en febrero de 1847 en el condado de Erie (Ohio), y ya desde su adolescencia manifestó vivísima vocacion por las ciencias físicas, empezando en tan temprana edad á dar pruebas de su extraordinaria potencia creatriz. Sus primeras invenciones fueron consagradas á perfeccionar los aparatos telegráficos, debiéndosele el *stock-telegraph*, que transmite los números con mucha mayor rapidez que el sistema Morse; el *cuadruple* telégrafo, que permite expedir a la vez y por un mismo hilo cuatro despachos, y finalmente, el *electro-motografo*, en que una simple combinacion química suple al empleo del magnetismo. Con tal continuidad y en número tan asombroso (pues pasan ya de 150) han ido sucediéndose los partos de tan fecundo genio, que su enumeracion completa requeriria un registro perpetuo. Entre sus inventos recientes sobresalen la *pluma eléctrica*, el *fonografo* (de cuyas aplicaciones y descripcion nos ocupamos en el presente número al reseñar la sesion experimental celebrada por el Ateneo libre de Cataluña), el *megafono*, el *aereofono* y el *electro-tarimetro*. La noticia de palpitante actualidad transmitida por la prensa de Nueva-York relativa á su último descubrimiento sobre la aplicacion de la electricidad á los alumbrados público y doméstico por la subdivision del foco en millares de luces ha causado honda sensacion en los mercados europeos y áun cuando el asunto está *sub-judice*, y no falta quien se empeñe en desvirtuarlo, no creemos que deba rechazarse su posibilidad, mayormente tratándose de ese atleta de la inteligencia que nos tiene acostumbrados á ver traducido en hecho práctico lo que ántes á duras penas hubiera osado imaginar la más soñadora fantasía.

1720



THOMAS ALBA EDISON

INVENTOR DEL FONOGRAFO

1721

Daily News Oct 31st 81.

On the occasion of the last performance at the Opera House, the Edison light was exclusively used in the large salon. The Prince and Princess of Wales and the Princess Imperial of Brazil and her husband went between the acts to study its effect. They were delighted with its softness and its truth. M. Garnier, the architect of the Opera House, and M. Baudry, whose beautiful paintings on the ceiling of the large saloon were menaced by the gas with rapid deterioration, also attended, and were thoroughly satisfied with the experiment. The Princess of Wales wore on this occasion a crimson dress of satin, and had diamonds in her hair and on her neck. Their Royal Highnesses occupied the box of the Duc d'Aumale. Yesterday they lunched with him at Chantilly, and the Prince had some sport in the preserves. The honours of the château were done by the Comtesse de Paris. Coffee was served in the library, which contains the richest collection of old and rare books in France. I may add that the Chapel of Chantilly will soon be enriched by a masterpiece of Baudry. It represents the conversion of St. Hubert. The stag, between whose horns a luminous cross appears, and the hounds that are pursuing him, are quite equal to any of the animals done by Courbet in his sylvan paintings. The Saint is richly dressed and accoutred for the chase. Oct 31 1881

1722

THE EDISON ELECTRIC LAMP CO.,

Thos. A. Edison,
Chas. Batchelor,
Francis R. Upton,
Edward H. Johnson.

Menlo Park, N. J., ... 188

Memorandum

By using chloride carbon
in ~~[illegible]~~ bulb it is decomposed
Carbon deposited & Chlorine
set free this removes all
traces Hydrogen it is the
Hydrogen that magnifies
the [illegible] Webster's [illegible]
lamp that gave 15 [illegible] per
h.p.

Given to Chas Batchelor by T. A. Edison
Jan 13th 1881 Chas Batchelor

1723
New York Times Nov. 2d

DEPREZ'S NEW DISCOVERY

ITS HIGH HONORS AT THE ELECTRICAL EXHIBITION.

PARIS, Nov. 2.—Mechanical physics present few questions of greater interest and importance than that of the distribution of electricity. The complete solution of this problem will insure the transmission of power to indefinite distances, its division into infinitesimal fractions, and the application of the solution must essentially modify the conditions of industry by endowing it with immense vitality. All systems for the production and transmission of electrical force which have been in use up to the present day are defective; its generation, except on a large scale, is expensive, and it cannot be transmitted to any great distance without great loss of power. Hence came the necessity of creating great centres of production and the establishment of vast workshops in their immediate proximity. This centralization of labor possesses, beyond doubt, advantages which cannot be ignored, but it has also its inconveniences, both moral and industrial. In this latter sense, the absence of personal initiative, the absorption of the individual in the mass, is one of the principal objections, and it results precisely from the fact that, at present, small forces cannot be put at the disposal of isolated workmen.

There are no very small motors producing very small amounts of power, and all those which fulfill, approximatively, that condition are open to criticism. Hot-air motors have been pronounced inferior to all other systems; the power supplied by steam motors cannot be reduced to a very low point; gas-motors, of which the utility is doubtful below a production of 15 kilogrammètres per second, are bulky and too costly for ordinary use. Still, until the application of electricity as a motive agent was contemplated, nothing better was at the disposal of manufacturers. Yet for some time it was contended that electricity could not furnish an amount of power sufficient for anything of importance. Recent experiments have, however, demonstrated that this judgment was erroneous, and that the first failures could be entirely attributed to the construction of electrical motors on a wrong principle, whereas the constitution of machines which generate electricity have completely changed the results. At present there exist a number of different electrical motors capable of furnishing every description of power, and we have the machines of Gramme, Siemens, and others analogous to these, for applications where large quantities of motion are required, and a series of smaller motors, among which the one invented by M. Marcel Deprez stands pre-eminent for cases where a lesser amount of power is necessary. All of these motors present like advantages, which are inherent to the very nature of electricity, in that they produce movement without any intermediate mechanism; they are axles, of which the rotation begins so soon as they receive the fluid; they can be set in motion or be stopped instantaneously; by the simplicity of their organism, they can dispense with the necessity of constant superintendence. All the small motors are of light weight and small dimensions, and they alone offer the inestimable advantage of the possibility of application to small works at the same tariff as to large ones.

To give a precise idea of these results I will quote figures: The Deprez motor of 10 kilogrammètres per second weighs 10 kilogrammes, (about 22¼ pounds avoirdupois;) a gas-motor of about the same capacity, 60 kilogrammes; a Gramme or Siemens machine of 2-horse power weighs 150 kilos and costs 1,200f.; a gas-machine of the same capacity weighs 2,000 kilos and costs 1,800f. I beg leave to call attention to the fact that, so far, I have only spoken of electricity in connection with the transmission and distribution of force; this is one of the greatest services, certainly, which electricity can render, but there are others, and notably those of illumination and chemical action—both to a certain extent limited at present by the difficulty, I may say the impossibility, of obtaining the fluid except at the place where it is generated. Until very lately the problem of the division of the current was not solved, and the public, so far as electrical illumination was concerned, was about where it would have been if each member of the community were obliged to manufacture his own gas. Divers experiments were made and divers results obtained, but all were merely approximative. By the assumption of certain favorable conditions, and by means of the introduction of regulating apparatus, either automatic or in the hands of superintendents, tolerably satisfactory solutions were found for certain simple cases, such as the installation of electrical light within a given perimeter. As far as it went this was well enough; the arrangements sufficed when similar apparatus were used under the same conditions, but they failed whenever there was a change in the apparatus, or some irregularity in those conditions. No system worked satisfactorily or freely over any considerable distance; none succeeded with different installations; not one presented a positive general solution. This solution has, it seems, been furnished by the laureate of the exhibition. M. Marcel Deprez, in his study of the problem, passed through all the preliminary phases, finding and putting aside as unsatisfactory every one of the solutions which, after him, other inventors have announced as definite. Among these was the constitution of a complete system of automatic regulators, which, although they did answer the conditions of the problem, he nevertheless rejected on the ground that their action was too slow and their arrangement too complicated for any such disposition to be practical.

There are two methods for the disposition of several apparatuses along the same source of electricity. By one they are placed in series, one after the other, on the same conductor—in which case they are said to be in "tension." By the other, each apparatus is connected with the main conductor by a branch wire; they are then in "derivation." The comparison will give a clear idea of the two methods. If several hydraulic wheels are placed one below another, under the same sheet of water, so that each wheel will utilize the totality of the volume and a part only of the height of the fall, they are in "tension;" whereas they are in "derivation" if all the wheels, being on the same level, profit by the totality of the height of the fall at the expense of a part of the volume of water. By analogy we can perceive the inconveniences of both systems; for wheels in "tension," should one stop the entire disposition is arrested in its movement; an accident to one of the apparatuses along the electrical circuit is repercussed in all the others, and to produce great force a heavy fall of water or a considerable dose of the electric fluid is indispensable, all of which makes the effects uncertain, and may be attended with dangers; on the other hand, the proceeding by "derivation" may render necessary large volumes of the motive force, not always easily procurable, at a particular point, and on that account expensive. Still, this latter system is preferable and should be adopted, except in special cases. The above comparison gives, also, the conditions of the *modus operandi* of the two systems; if the wheels are in "tension," that is, superposed, it is the height, not the volume, of water which must be modified whenever the number of the wheels varies, while the volume and not the height is the main consideration if the arrangement be in "derivation." So it is with electricity; the apparatuses which are placed in a series demand a constant intensity of current with a variable tension; if those apparatuses be in "derivation," the "tension" must be constant, while the intensity may be variable.

M. Marcel Deprez made also a careful study of the nature of the action of the dynamo-electrical machines which, previous to his experiments, had not been thoroughly understood, as they had been merely examined from a practical point of view. His analysis was very complete, and he ascertained that all those machines contain within themselves, and without the necessity of any mechanical accessory apparatus, a means for the self-regulation of their currents, whether employed in "tension" or in "derivation." His theory and mode of proceeding are exceedingly simple. The dynamo-electric machine produces a current by the action of electro-magnets which receive their magnetization from a current furnished by the machine itself. Thence, by a series of calculations as profound in reality as they are simple in appearance M. Marcel Deprez found that, if this magnetization were produced by a combination of two currents, one borrowed from the machine, the other from an exterior fixed source of electricity, the current so engendered will be in proportion to the outside current, and will furnish constantly the precise amount of power required. To illustrate this theory, or rather the advantages which he attributes to this combination, he resorts to a comparison, trite but striking. The machine, in its ordinary state, that is, deriving its current exclusively from itself, is in the position of a man who has in hand an affair from which he might realize great profits, but to carry out which he lacks capital; unable to make the necessary preliminary outlay, his situation must always be precarious. On the other hand, a machine dependent entirely upon a foreign source for its electricity resembles an individual with nothing except a fixed annual revenue which he cannot increase so as to better his condition. Finally, the machine in which the electrical excitation is produced by combined action is in the position of him who disposes of both resources; he has at once an affair which may bring him in unlimited profits and the funds wherewith to set it a-going and insure its success. The first applications of the Deprez theory were made at the Palais de l'Industrie, barely three months after its conception. Forty apparatuses were placed in "derivation" on the same circuit of two kilomètres in length; these apparatuses consisted of small Deprez motors which put in motion a number of sewing-machines, plaiting-machines, machines for galvanoplastic, turning-lathes, ventilators, Guilcher and incandescent regulators, &c., and finally, a Marinoni printing-press, 2 mètres in breadth by 3.50 mètres in length. The generator was composed of the combination of a Gramme machine — model A — weighing 280 kilogrammes and making 2,000 revolutions per minute, with a Siemens weighing 64 kilogrammes and making 800 revolutions; the circuit was composed of two cables, each one kilomètre in length; each cable consisted of several copper wires, together having a diameter equivalent to six millimètres; the motor—gas—has a force of 4-horse power; the wires, branch wires as I may call them, which serve to form the "derivation," are each of the diameter of one-third of a millimètre. Not one of the above-mentioned apparatuses was specially constructed for this experiment; in no one case was any modification necessary. The apparatuses were placed at irregular intervals along the circuit, the printing press stood at one end of the palace, at the other extremity 10 different machines were agglomerated within a few yards of each other, while at a dozen other points, on the ground floor and in the galleries, were other machines. All worked entirely independently; any one could be set in motion or stopped at pleasure by simply turning a key, without interfering with the rest, while, as M. Marcel Deprez had contended, it was found that the gas machine could be made to modify its expenditure of gas in proportion to the amount required for any given purpose. This experiment is conclusive in every respect; the inventor next proposes to show that the system can be applied on a large scale and announces, as his next operation, the transmission of 40-horse power over a distance of 50 kilomètres—about 31¼ miles—and its division along the line into 40 unequal parts, which shall be employed for the working of such machines as may be selected by the commission.

M. Marcel Deprez was not an exhibitor; he has always devoted himself to mathematical and applied science, as a scientist, and always without any reference to the personal benefits which he might derive from his discoveries and inventions, although all—twice crowned by the French Institute—bear the stamp of practical, as well as theoretical, genius. He has furnished solutions to the most difficult problems. To him the world owes the machine by which can be studied and determined the different phases of movement of a projectile within the bore of a cannon; his chronogrammeter admits of the division, into 20 fractions, of the few hundredths of a second during which the projectile remains within the piece after its discharge; his instruments estimate the one hundred thousandth part of a second. It was he who invented for the Eastern France Railway Company the dynamometer wagon, in which can be studied and noted automatically from a distance everything taking place within the cylinder of the locomotive. He constructed the first practical machines for measuring electricity, and even before he had solved the great problem of its distribution, had created the apparatus wherewith to measure its force, which later will serve to estimate the quantity of fluid supplied to each consumer. None of the many inventions bearing his name were presented at the exhibition by M. Deprez, and even in that for the distribution of electric force he was represented by his engineer, M. Guichard. Still, the jury considered that he was entitled to a direct reward, and, therefore, awarded to him the highest—the diploma of honor—for the latest, and by far the most remarkable, of his discoveries. The brilliant merit of the inventor entirely justifies this distinction, but for the invention itself, such is its importance, the recompense is almost insufficient.

1724

MONITEUR OFFICIEL DE L'ELECTRICITI

Novembre 5th 1881.

1727

LA LUMIÈRE EDISON

Malgré l'évidence et au mépris des témoignages, chaque jour plus nombreux et significatifs, que les *faits* nous apportent, il se trouve encore des… savants qui contestent *mordicus* l'application de la lumière électrique aux usages de la vie intérieure. Quel inexplicable sentiment peut dicter ces résistances obstinées de la part d'hommes érudits, loyaux et désintéressés? Dernièrement, un grand-prêtre du *Soleil*, après avoir exposé en termes éloquents les progrès réalisés par l'électricité pour l'illumination des voies publiques, ajournait de sa propre autorité au vingtième siècle l'intronisation à domicile de la lumière par incandescence, sous ce prétexte qu'il faut laisser à nos descendants quelque chose à découvrir. Quel thème à plaisanteries dans de pareils arguments émis avec le plus grand sérieux par un écrivain d'esprit et de talent! Nous en sommes toujours à l'anecdote si drôlement racontée par Edouard Fournier de je ne sais plus quelle invention que l'Académie des sciences repoussait comme impraticable alors même qu'elle fonctionnait depuis six mois sur le Pont-neuf, au vu et su de tous les galopins de la capitale.

Eh bien, quoi qu'en pensent et quoi qu'en disent MM. les savants plus ou moins officiels, et, à leur suite, certains praticiens qui ne veulent rien voir au delà de l'arc voltaïque, le succès de l'incandescence est aujourd'hui certain et complet; et dans un temps fort peu éloigné, nous assisterons à l'extinction du gaz sur toute la ligne. Cette fois encore, cet admirable Edison, la bête noire de la routine scientifique, a triomphé des incrédules et forcé ses adversaires les moins conciliants à s'incliner devant la puissance de son génie pratique. L'éclairage, par l'électricité, du foyer domestique est donc un fait accompli.

Aux Etats-Unis et en Angleterre, un grand nombre d'établissements et de maisons sont déjà en pleine incandescence, et si la belle invention de l'illustre hôte de Menlo Park ne rencontre pas chez nous les obstacles que l'administration française aime à dresser devant toutes les innovations utiles, avant quelques mois, tout un quartier de Paris jouira des incontestables avantages du nouveau procédé d'éclairage.

Et quand nous affirmons que les recherches d'Edison ont enfin abouti d'une manière heureuse et définitive, que l'on n'aille pas supposer que nous prenons nos rêves pour des réalités. A vrai dire, ce n'est pas nous qui parlons en ce moment, bien que nous sachions les choses aussi bien que personne; mais, pour l'instant, nous tenons à céder la parole à des personnages dont l'autorité ne saurait être suspectée. Ainsi, c'est le *Journal des Débats* qui constate, avec de grands éloges, que l'éclairage des appartements élégants, d'où le gaz est proscrit, appartient désormais à la lumière d'Edison! Et il ajoute : « Le gaz suivra la destinée de toute chose ici-bas qui est combattue par une autre mieux organisée. Il sera vaincu. C'est le sort des faibles! » A son tour, le *Temps* s'exprime en ces termes assez significatifs: « La contradiction n'est plus possible aujourd'hui. Edison, il est de toute justice de le reconnaître, a réalisé l'éclairage domestique par l'électricité. La question est sortie du domaine de l'expérience, des tâtonnements dans le cabinet du savant pour entrer dans la pratique. » Vient maintenant la *République française*, une feuille que sa condition condamne à la plus extrême réserve, et qui nous annonce que « la grande nouveauté que l'Exposition internationale met dans une éclatante lumière—nouveauté très inattendue, il faut le dire hautement, pour les hommes de science comme pour les hommes de pratique dans notre vieille Europe—c'est la lampe à incandescente. Le succès incontestable du nouveau système surprend un peu les savants, de même que sa souplesse émerveille les gens du monde parce que les principes sur lesquels il repose avaient plusieurs fois tenté les inventeurs comme les physiciens et s'étaient toujours jusqu'ici montrés stériles en résultats vraiment pratiques. Mais les deux races anglo-saxonnes, les Etats-Unis et l'Angleterre, ont rivalisé d'efforts pour atteindre le but, et cette fois encore, on a prouvé le progrès en marchant au nez des sceptiques. »

C'est déjà bien, mais voici mieux. Ce n'est pas un profane qui va parler, c'est un spécialiste de première catégorie, directeur scientifique de la *Lumière électrique*, la publication la plus remarquable peut-être de la famille des électriciens, et peu habituée aux concessions complaisantes. Ecoutez-le :

« Tous ces essais, dit M. du Moncel en parlant des tentatives faites jusqu'en 1879 par divers physiciens, n'avaient que médiocrement réussi, pour ne pas dire plus, et quand, en 1879, on annonça la nouvelle lampe à charbon incandescent de M. Edison, beaucoup de savants et MOI-MÊME EN PARTICULIER doutèrent de l'exactitude des allégations qui nous venaient d'Amérique.

« Pourtant M. Edison ne se tint pas pour battu et, malgré la vive opposition qu'on fit alors à ses lampes; malgré la polémique acerbe dont il fut l'objet, il ne cessa de les perfectionner au point de vue de la pratique, et il est arrivé aujourd'hui aux lampes que nous voyons à l'Exposition et dont tout le monde peut admirer la parfaite fixité. »

M. du Moncel s'exécute, comme on le voit, avec la bonne grâce d'un esprit vraiment élevé et la loyauté d'un honnête homme, et, après avoir ainsi fait amende honorable devant l'ex train-boy du Michigan, il déclare que « ce que les incrédules ont de mieux à faire maintenant, c'est de s'incliner devant les faits. »

Ainsi nos petits-neveux n'auront pas la peine d'inventer la lumière électrique qui leur arrivera avec les perfectionnements qu'elle aura reçus d'ici à la fin de ce siècle. S'ils tiennent à découvrir quelque chose, comme on le demande au *Soleil*, ils pourront retrouver les antiques réverbères et la *chandelle des seize*. Ça sera peut-être alors un progrès et les inventeurs passeront pour des hommes de génie. Heureux « retour des choses d'ici bas! »

Il nous semble que la preuve est complète, absolue, et nous pourrions nous borner à ces citations. Mais la personnalité d'Edison nous est tellement sympathique qu'il nous en coûte de le quitter quand nous nous trouvons avec lui. Que l'on veuille donc bien nous permettre d'apporter un dernier document à l'appui de la cause archivictorieuse de l'incandescence.

Les Yankees, en affaires, ne sont ni des jobards ni des gogos. S'ils ne marchandent pas leurs dollars aux tentatives aventureuses et s'ils n'attendent pas pour encourager, par leur argent, les essais des inventeurs que ceux-ci soient morts de misère, ils ne se passionnent pas d'ordinaire pour des chimères et ils ne jettent pas leur or aux chercheurs de la quadrature du cercle. Eh bien, parcourez cet extrait d'un des principaux organes de la presse de New-York, le *Sun*, et fussiez-vous aussi sceptiques que saint Thomas lui-même, il vous faudra baisser pavillon devant la réalité en chair et en os.

« On dit que la valeur actuelle des actions et parts de M. Edison dans les diverses Compagnies qui ont été formées pour exploiter sa lumière incandescente est de 4 à 5 millions de dollars; mais les entreprises ne sont encore que dans un état préparatoire. Une organisation est élaborée et donne lieu à beaucoup de travaux. Il y a une Compagnie de la Lumière électrique Edison pour le Nord et le Midi de l'Amérique, une Compagnie anglaise et une Compagnie européenne. M. Egisto P. Fabbri de la maison Drexel Morgan et Cie est parti dernièrement pour l'étranger, dans l'intérêt de la Compagnie anglaise qui doit exposer à Londres sous peu. La Compagnie européenne va exposer à Paris. Il y a des Compagnies distinctes pour la fabrication des lampes, des machines dynamo-électriques et des tuyaux par lesquels le courant est transmis dans les rues et dans les maisons. La vente de la force motrice à New-York et de la lumière électrique Edison appartient à la Compagnie « Edison's Electric Light Illuminating Company » qui a été constituée en janvier 1881.

« Cette compagnie qui s'est d'abord adressée à toute la ville avant de poser ses fils, s'arrange en ce moment pour éclairer deux districts. Le plus grand progrès a été fait dans la partie inférieure de la ville bornée par Wall, Nassau, Spruce, Ferry Streets et Peck Slip, la East River formant la limite de l'est. La Compagnie fait savoir que, dans ce district, elle a déjà posé ses fils dans 980 maisons pour l'introduction de la lumière et qu'elle a fait des traités avec environ 1,100 consommateurs. Elle occupe quarante ouvriers en ce moment pour la pose de ses fils. Les traités déjà faits dans ce district nécessiteront 9,000 becs de lumière de la force de 16 bougies et 4,000 de la force de 8 bougies chaque. La Compagnie s'engage également à fournir de la force-vapeur jusqu'à 5 chevaux à toute personne qui en fera la demande et elle entend faire marcher à l'électricité 617 monte-charges et 55 élévateurs dans ce district. Les fils ont été posés dans une grande imprimerie pour 647 foyers de lumière, une autre pour 550 foyers. L'autorisation pour la pose des tuyaux de service dans les rues a été obtenue, et la Edison Electric Tubing Co. 65, Washington Street, fabrique un kilomètre de tuyaux par semaine. On aura besoin de 13 kilomètres de tuyaux dans ce district. Les tuyaux en fer qui transmettent l'électricité sont de deux pouces de diamètre, contenant deux conducteurs en cuivre d'un pouce de largeur et d'un quart de pouce d'épaisseur séparés l'un de l'autre et de l'intérieur du tuyau par une substance isolante. Des contrats ont été passés pour les travaux de terrassement dans les rues : les maisons 255 et 257 Pearl Street ont été achetées pour installer la station centrale d'éclairage de ce district. Des traités ont été faits avec une maison de Philadelphie pour la construction et la livraison le 16 septembre de 12 machines à vapeur Porter, d'une force moyenne de 125 chevaux chaque. Ces machines avec leurs dynamos, généreront l'électricité pour ce district; mais il est estimé qu'on n'aura jamais besoin de faire fonctionner plus de 8 de ces machines sauf quelquefois dans les après-midi d'hiver quand on aura besoin de la lumière et de la force en même temps. La Compagnie s'attend à ce que, dans ce district, ses bénéfices de la vente de la force-vapeur seulement donneront un dividende sur le capital employé indépendamment de l'argent reçu pour vente de la lumière. Elle se propose de faire payer pour la lumière le même prix que les Compagnies du gaz, et elle fera ses comptes de la même manière, d'après la quantité d'électricité consommée enregistrée par les compteurs.

La fabrique de lampes à Menlo-Park produit 1000 lampes par jour en ce moment. La durée moyenne d'une lampe est de 8 mois. Les consommateurs ne paieront rien pour les lampes. La Compagnie des lampes a fait l'acquisition de la grande fabrique de la Peters Manufactory Company à Newark et fait des installations qui doivent la mettre à même de fabriquer 10,000 lampes par jour. Cette Compagnie a passé un traité avec la Compagnie de la lumière Edison pour la fourniture de lampes à un prix qui ne doit pas dépasser 25 cents par lampe.

Le second district à éclairer est borné par Madison et Eighth, avenues Twenty fourth Thoity fourth Streets. Dans ce district il y a 214 pompes pour puiser l'eau et la monter aux étages su périeurs; 2,309 machines à coudre, et une force-vapeur de totale de 1,423 chevaux employée pour faire fonctionner les monte-charges et les élévateurs. La Compagnie va faire un contrat pour fournir des moteurs électriques pour faire tout cela. Si les machines sont prêtes à temps, la Compagnie espère pouvoir éclairer le district inférieur au mois d'octobre. Les constructions de Goerck Street, appartenant autrefois à The Etna Iron Works, ont été achetées et on y fait des installations en ce moment qui vont coûter 250,000 dollars avec des machines pour la manufacture des dynamos, compteurs et moteurs. On y travaille jour et nuit aux appareils destinés aux deux districts à éclairer. La vente de machines séparées pour les hôtels et fabriques en dehors de la Cité se fait par la Compagnie sœur. Il y a un département spécial pour la marine et beaucoup de navires à vapeur sont déjà éclairés par la lumière Edison. La semaine dernière les fils ont été posés à la maison Durant House à Blue Mountain Lake, dans les Adirondracks, et l'hôtel sera pourvu des machines pour la production de la lumière. La compagnie Edison de lumière électrique est propriétaire d'un brevet pour un chemin de fer électrique et on fait déjà des essais sur un chemin de fer d'un kilomètre de longueur à Menlo Park. Aussitôt que la première station, à New-York, sera éclairée, une section de ce chemin de fer doit marcher à l'électricité en vertu d'arrangements déjà faits, afin de vérifier les résultats pratiques qu'on peut attendre de l'invention. »

Dans un de nos prochains numéros nous donnerons quelques renseignements dignes d'intérêt sur ce chemin de fer électrique de Menloo Park dont Edison, ce Protée invraisemblable, poursuit les derniers perfectionnements tout en continuant ses recherches fécondes sur la lumière et sur le son. Ce n'est certes pas pour décerner à l'inventeur américain des louanges dont il n'a nul besoin et dont il ne s'inquiète guère que nous avons écrit cet article, mais pour notre propre justification aux yeux de certains censeurs qui nous ont reproché de nous être emballé un peu loin dans la biographie si sincère que nous avons consacrée au plus illustre physicien de l'époque. Cette fois, nous nous serons emballé en bonne et nombreuse compagnie !

LES COLLABORATEURS D'EDISON

Le *Temps*, dont nous citons l'opinion dans l'article qui précède, publie les renseignements qu'on va lire en rendant un juste hommage aux dignes représentants d'Edison à Paris. Nul ne songera à nous contredire quand nous ajouterons que ces messieurs, par leur aménité et leur complaisance inépuisable, auront largement contribué à vulgariser l'œuvre d'Edison et à lui concilier les sympathies de la foule. Nous sommes heureux pour notre compte de l'occasion qui se présente de leur donner un témoignage public d'estime et de gratitude. Voici ce que dit le *Temps* :

« M. Bachelor, qui est l'*alter ego* de M. Edison, son ami et son collaborateur de la première heure; qui a partagé toutes ses études et tous ses travaux; qui, seul au monde, est au courant des projets et des idées de l'illustre inventeur; qui, aidé par le docteur Otto A. Moses et par M. Baylo, a dirigé avec une remarquable intelligence la splendide installation de l'exposition Edison au Palais de l'Industrie, dotera Paris des merveilles dont les habitants de New-York jouissent déjà. En Amérique, la lumière Edison court les rues, gravit en ce moment tous les étages, pour jeter bientôt sa douce clarté dans les appartements les plus reculés. Le plan d'un quartier de New-York est installé dans la salle 24 avec ses immenses bâtiments où circulent les fils électriques, ses rues traversées par les canalisations souterraines, sa fourmilière de lampes, ses installations de machines motrices et de générateurs d'électricité.

« Nous croyons savoir qu'à la fin de l'année, Paris n'aura rien à envier sous ce rapport à New-York. M. Bachelor crée en ce moment, dans Paris, des ateliers dont il prend la direction pour la fabrication en grand des appareils du système d'éclairage Edison. Aussitôt qu'il en aura en quantité suffisante à sa disposition, il procédera à leur installation dans divers quartiers de la capitale. L'époque n'est donc pas éloignée où nous pourrons remplacer avec économie nos lampes fumeuses, à huile, à pétrole ou à gaz, emplissant nos appartements d'une odeur âcre, par la lumière si pure de la lampe du savant de Menlo-Park. »

C'est donc la fin de ton règne, ô gaz nauséabond, incendiaire et assassin ! Si tu as rendu des services, tu les auras fait payer chèrement !

MONITEUR OFFICIEL DE L'ÉLECTICITÉ

Nov 5th 1881

LA GRANDE MACHINE

DYNAMO-ÉLECTRIQUE D'ÉDISON

à l'Exposition internationale d'électricité

1428

La grande machine électrique envoyée par Edison au Palais de l'industrie est sans contredit la plus grande machine dynamo-électrique qui ait jamais été construite. Elle est semblable, comme construction, aux machines avec lesquelles on se propose d'éclairer un certain quartier de la ville de New-York et pour l'installation desquelles on est en train de poser des conducteurs souterrains afin d'amener les courants de la station centrale aux diverses habitations et aux divers magasins qui pourront adopter ce mode d'éclairage.

L'appareil complet comprend une machine à vapeur horizontale de 125 chevaux et une machine dynamo-électrique de dimension énorme ; le tout fixé sur une seule plaque de fondation de manière à constituer une machine unique.

On se fera une idée de sa taille quand on saura que l'appareil complet ne pèse pas moins de 17 tonnes, dans lesquelles les aimants du champ magnétique comptent pour 10 et l'armature tournante pour plus de 2,5 tonnes.

L'arbre de la machine motrice est placé dans le prolongement de celui de la machine électrique, et ces deux arbres sont réunis par une paire de disques munis de boutons de manivelle avec une barre d'accouplement. Dans cette disposition comme dans celle adoptée par Brotherhood, on évite toutes courroies de transmission et par suite l'extinction subite de la lumière par glissement d'une de ces dernières.

La machine motrice est munie d'un régulateur très symétrique ressemblant comme forme extérieure à un volant, monté sur l'arbre principal, de manière à n'offrir à l'air que peu de résistance; il agit directement sur l'excentrique dont il augmente ou diminue le rayon d'excentricité, de manière à régler le moteur en faisant varier la course du tiroir.

La machine dynamo-électrique est identique, comme principe, aux machines plus petites du même inventeur, mais, outre sa taille colossale, elle présente encore certains caractères distinctifs de construction.

Le champ électrique est produit par 8 électro-aimants cylindriques très longs (d'environ 2m40) fixés sur une position horizontale et dont les bobines sont en dérivation du circuit principal de la machine.

Trois de ces électro-aimants sont fixés à la pièce polaire inférieure, tandis que les cinq autres sont fixés au-dessus des premiers, sur la pièce polaire supérieure.

L'armature de la machine de M. Edison est certainement la partie la plus intéressante et la mieux disposée de l'appareil. En principe, elle appartient au type Siemens à courant droit mais les communications y sont très différentes et se rapprochent plutôt de celles de la machine Gramme. L'armature est de forme cylindrique et tourne avec une vitesse de 350 tours par minute dans un cylindre creux formé par les deux pièces polaires sur lesquelles sont fixés les électro-aimants. La construction de l'armature ne comporte aucun fil ; la partie induite se compose d'un certain nombre de barres de cuivre rectilignes ayant en coupe transversale la forme d'un trapèze; ces barres sont disposées autour de la circonférence du noyau cylindrique en fer laminé et sont isolées l'une de l'autre par du papier brouillard préparé. Un certain nombre de disques plats ou rondelles de cuivre sont placés à chaque extrémité de l'armature et enfilés sur l'arbre central ; le nombre de ces disques est égal au nombre des barres de l'armature et ils sont, ainsi que ces dernières, soigneusement isolés l'un de l'autre. Chacun des disques est relié par sa circonférence avec l'une des barres induites, tandis que la barre diamétralement opposée de l'armature est reliée au même disque en un point de sa circonférence diamétralement opposé à celui de sa communication avec la première barre. Cette dernière est reliée d'une manière analogue à la circonférence d'un des disques placés à l'autre bout de l'armature, lequel communique à son tour avec l'extrémité de la barre voisine de celle que nous avons prise comme point de départ. L'extrémité opposée de la troisième barre est fixée à un nouveau disque placé à l'extrémité de l'armature, et ainsi de suite, jusqu'à ce que toutes les barres soient renfermées dans un circuit électrique continu. On verra que, de cette manière, le noyau de fer est, électriquement parlant, entouré d'un conducteur métallique, de sorte qu'un courant électrique qui lui est transmis, arrive par une des barres à l'un des disques placés à l'extrémité opposée de l'armature; passe par la barre opposée dans un disque placé à l'autre exrémité pour se refermer sur la barre contiguë à celle par laquelle il a commencé.

Par cette simple disposition, la résistance de l'armature et spécialement celles des parties inactives de ses extrémités se trouve réduite au minimum, et on évite en outre ainsi la complication gênante de fils des armatures du système Siemens

Par suite la communication de chacune des barres avec le disque qui suit celui auquel la barre précédente était reliée, la ligne de fonction entre les barres et les disques est disposée suivant une hélice disposée aux deux extrémités de l'appareil. Les barres sont cependant exactement de la même longueur, celles qui saillissent davantage à l'une des extrémités de l'armature ont une saillie moindre à l'autre extrémité. Dans la machine que nous décrivons, il y a 138 barres et autant de disques conducteurs ; les barres ont environ 1m05 de longueur dont 1 mètre environ compris dans le champ magnétique.

A l'extrémité de la machine, qui est la plus éloignée du moteur, est placé un commutateur du type Gramme et Siemens formé de 138 secteurs de cuivre isolés et communiquant respectivement avec les disques de cuivre et contre lesquels les balais collecteurs pressent en vertu de leur élasticité; la pression et la position des balais sont réglées au moyen de tiges de réglage, actionnées au moyen de vis sans fin et de roues hélicoïdales.

Le commutateur a environ 225 millimètres de long et il y a deux larges balais collecteurs formés chacun de huit pinceaux distincts.

La force électro-motrice de cette machine est de 103 volts à la vitesse de 350 tours par minute; elle alimente 2,000 demi-lumières ou 1,000 lumières entières. A l'entrée centrale nord de l'Exposition seront suspendus dix cadres de bois tendus d'une toile métallique à laquelle sont accrochées les lampes.

Les conducteurs sont de fortes tiges de cuivre ayant en coupe transversale la forme de segments de cercle; ils sont enrobés dans une matière résineuse renfermée dans des conduites de gaz, placés sous le sol en travers de l'Exposition; ces conducteurs ont la même section et les mêmes dimensions que les conducteurs principaux qui font partie de l'installation d'Edison à New-York.

1429

Morgen-Zeitung

1732 August 14th 1881

1733

Die internationale elektrische Ausstellung zu Paris.

(Original-Bericht.)

I.

Paris, den 10. August.

Ein eigenes Verhängniß umschleiert in unserem merkwürdigen Jahrzehnt die internationalen und nationalen industriellen Wettkämpfe, die wir gemeinhin mit dem Namen „Ausstellungen" bezeichnen. Welch' mühevolle Arbeit, welch' rastloses, jahrelanges Schaffen und Wirken, welch' enorme Geldopfer gehören heutigen Tages dazu, um eine Ausstellung von Rang und Klang in Scene setzen zu können und ihr einen allseitigen oder reichen Beifall zu sichern. Darf es daher Wunder nehmen, wenn die Nationen, welche sich die Aufgabe einer „Welt-Ausstellung" stellen, auch für die Eröffnung derselben eine entsprechend würdige äußere Ausstattung und Formalität beanspruchen?

Gleich wie die unscheinbare Champagnerflasche durch ihr blitzendes Zerschellen an der ehernen Wand unserer mächtigen Panzerkolosse unter üblichem Salut der gesammten Schiffsmannschaft ein günstiges Omen für die Wohlfahrt des schwarzen Seeungethüms darbietet, so wünscht man aus der richtigen, wenn auch maßvollen Eröffnungsfeier einer Weltausstellung, derselben ein Glück verheißendes Prognostikon zu stellen. Wir sind in diesem Jahre mit einer ganz respectablen Anzahl von Ausstellungen in aller Herren Länder fast „überschüttet", und begrüßten die französische Nation daher mit Freude, daß sie auf den sehr zeitgemäßen Gedanken kam, zu „Paris" eine „Elektricitäts-Weltausstellung" in Scene zu setzen. Der Eröffnungstag einer „Elektricitäts-Ausstellung aber mußte ja dieser jungen, jetzt schon so Gewaltiges leistenden, Naturkraft entsprechend ein ausnahmsweise splendider und großartiger werden. Darüber war man sich völlig einig. Der Termin dieses hohen bedeutungsvollen Festtages war anfänglich am 15. August festgesetzt. Darauf kam man jedoch überein, die Publication schon 14 Tage früher erfolgen zu lassen. Als dieser Zeitpunkt aber näher rückte, sah man ein, daß dieser Wunsch leider verfrüht war, und setzte nun bestimmt den 11. August als Termin der Eröffnung fest. Alle französischen und auswärtigen Journale verbreiteten diese Nachricht in alle Welt. Aber Mr. Jules Grévy, der allmächtige „Präsident der französischen Republik", dachte anders und beliebte heute Vormittags ganz unerwartet in Begleitung seiner Gemahlin und Tochter die Elektricitäts-Ausstellung in Person zu eröffnen. Begleitet von Mr. Cochery, dem Minister der Post und Telegraphen Frankreichs, Mr. Berger, dem General-Commissar der Ausstellung, erschien er gegen 11 Uhr am Haupt-Portal des „Palais des Champs-Elysées" und trat in die interessanten Hallen der „elektrischen Wissenschaft" ein, empfangen von den lustigen Klängen der „Marseillaise" der garde-republicaine-Kapelle. Von hervorragenden Persönlichkeiten bemerkten wir Mr. und Mde. de Lesseps, Admiral Cloué, den französischen Marineminister, General [illegible]bert, General Pittié, Alphand, den Director der Arbeiten von Par[is], ferner die Deputirten Cantagnal, Grepo, Mr. Teisserenc de Bo[rt] und Becquerel, Professor am Institut für Physik und Metereologie. Die fremden Commissare, sowie fast alle Berichterstatter aber waren abwesend, ebenso auch der gerade aus Wien hier eingetroffene König der Sandwich-Inseln, Kalakaua, der jedoch, wie wir hören, der Ausstellung morgen Abend, bei entfalteter elektrischer Beleuchtung, einer großen Zahl der eigenartigsten und neuesten Systeme seinen Besuch zugedacht hat. Präsident Grévy besichtigte unter Anderem längere Zeit die deutsche Abtheilung und amerikanische Section, fuhr im elektrischen Waggon der Gebrüder Siemens unter Führung des Mr. Berger vom Ausstellungspalast nach dem „Place de la Concorde", hörte darauf ein „telephonisches Concert" und sprach bei seinem Abschiede seine volle Anerkennung gegen Mr. Berger aus. Letzterer dankte dem Präsidenten der Republik, und nach Abfahrt der hohen Personen um 12¼ Uhr öffneten sich die Pforten bereits dem großen Publikum.

Die einzelnen Abtheilungen dieser hoch interessanten und wichtigen Ausstellung werde ich dem geneigten Leser in meinem nächsten Bericht schildern, und will nur heute noch einige allgemeine Streiflichter durch die elektrische Atmosphäre ziehen.

Der Glanzpunkt der gesammten Ausstellung wird voraussichtlich in der Beleuchtung liegen. Der Palast in räumlicher Beziehung ungefähr drei Mal so groß als die Haupthalle der diesjährigen Breslauer Ausstellung, wird, allabendlich von 8 bis 11 Uhr von nicht weniger als ca. 1800! elektrischen Lichtern von der stärksten möglichen Licht-Intensität herab bis zur einfachen elektrischen Privat-Zimmerbeleuchtung erhellt und verspricht die Eleganz und das Feenhafte dieses silbernen Lichtschimmers ein Schauspiel darzubieten, welches alle bisherigen Feste der Illuminationskunst in vollkommenen Schatten stellen wird.

In einem der oberen Galeriesäle zählte der Verfasser an einem Lustre, der die elektrischen Lichter in Form von kleinen apfelgroßen reizenden Blumenglöckchen in architektonisch kunstvoll verschlungenen goldenen Ranken zeigte, allein 80 elektrische Flammen nach dem System „Swan". In einem anstoßenden Saale hat derselbe Erfinder weitere 520 Lichter, und „Edison" nach seinem neuesten „Bambus-Kohlen-System" gar „1000" elektrische Flammen in zwei Sälen in allen möglichen anscheinend vollkommen praktischen Combinationen vorgeführt.

Fleißig ist der Erfinder des „Phonographen", das muß man ihm lassen, und dürfte sich bei ihm das Sprüchwort bewahrheiten, daß eisenfeste Ausdauer und Beharrlichkeit stets zum Ziele führen! —

Eine elektrisch getriebene Gondel von Trouvé, ein elektrisch getriebenes Luftschiff von Tissandier, das seine Fahrten direct im Ausstellungspalast vollführt, eine völlig elektrisch erleuchtete Theaterbühne, eine Erinnerung an Nizza (!) (auch Prag), selbstleuchtende Bilder und Gegenstände, zahlreiche praktisch angelegte, dick gepolsterte „Telephon-Cabinets, nicht größer als ein halber Kleiderspind, die aber inmitten des stärksten Getöses jeden Schall vollkommen dämpfen 2c. 2c. — alle diese wunderbaren Erfindungen der „letzten Tage" wird der Besucher hier mit Muße schauen können.

Meine deutschen Freunde aber werden nicht wenig erstaunt sein, wenn ich nach allabendlichem dreistündigen Genuß von circa 2000 elektrischen Flammen nach den Untersuchungen von Siemens, der die starke belebende Kraft des elektrischen Lichts nachwies, hier in Paris den modernen „Brunnen der Jugend" von Lucas Cranach entdeckt, und wenigstens um 10 Jahre verjüngt in meine Heimath zurückkehre. E. Hinkefuß.

1734 Magdeburgische Zeitung Sept 28th 1881

Der Congreß der Elektriker und die internationale Elektricitäts-Ausstellung zu Paris.

Paris, im September 1881.

Seit einer Woche tagt in den Räumen des „Palais de l'Industrie" der Champs-Elysées ein Congreß nicht zum lang gezogenen Berathen von verfänglicher Friedens-Präliminarien nach vorangegangenen heißen Kämpfen, sondern ein Congreß der Wettkampfe auf friedlichem Felde, eine Vereinigung der berühmtesten Männer aller Nationen auf dem wichtigen Gebiete der „elektrischen" Wissenschaft. Wenn ein Zweig der modernen Industrie, der befruchtenden Wissenschaft verdiente, in diesem Jahre zum Range einer „internationalen" Ausstellung erhoben zu werden, so müssen wir es als einen völlig richtigen Einblick in unsere heutigen Verkehrsverhältnisse bezeichnen, daß Mr. Cochery, der Minister der Post und Telegraphie Frankreichs, dem Präsidenten der Republik die Abhaltung eines „Elektriker-congresses," verbunden mit einer „Elekt[ri]citäts-Weltausstellung zu Paris v[or]schlug.

Schon nach kurzer Zeit liefen zu Anfang d. J. von fast sämmtlichen hervorragenden Culturvölkern: Vereinigte Staaten von Nordamerika, Großbritannien, deutsches Reich, Oesterreich, Belgien, Rußland, Italien, Schweden und Norwegen, Schweiz und Niederlande zusagende Betheiligungsschreiben ein, und so konnte denn der Congreß pünktlich am 15. September eröffnet werden, während die Ausstellung der elektrischen Maschinen und Apparate für die Tagesstunden vom 10. August, und für die Abendzeit seit dem 27. August dem Publicum offen steht.

Minister Cochery hat im Verein mit dem Generalcommissar der Ausstellung, Mr. Berger, so wie dessen Assistenten, Mr. Breguet, hier im Palais der Champs-Elysées den Grundstein zum „Elektrischen Zeitalter" gelegt. Der elektrische Strom, dessen praktische Verwendung im Großen zur Telegraphie und zur Galvanoplastik erst seit einem halben Jahrhundert datirt, hatte bis vor wenigen Jahren außer diesen beiden Richtungen und dem medicinischen Gebiete keine weitere nennenswerthe größere Verwendung in Industrie und Verkehr finden können. Wohl muß man zugeben, daß die Leistungen der Elektricität besonders auf den beiden ersteren Gebieten des Signalwesens und der elektrolytischen Metallscheidung ganz außerordentliche zu nennen waren, [die] selbst die kühnsten Erwartungen weit hinter [sich] zurückließen, hat man doch beispielsweise allein [im] deutschen Reiche in der Zeitperiode von 1872 bis 1880 eine Zunahme der aufgegebenen Telegramme von rot. 9½ Millionen auf rot. 13½ Millionen constatirt! Allein erst unserem letzten halben Jahrzehnt war es vorbehalten, die allgewaltige Macht des elektrischen Stromes, welche wir freilich zum Theil schon früher geahnt hatten, plötzlich in fast unmöglich scheinender Größe und Reichhaltigkeit zu enthüllen und für die industriellen Richtungen hundertfältig zu verwerthen. Schlag auf Schlag folgten in der winzigen Spanne Zeit von „fünf" Jahren die folgenschwersten und großartigsten Entdeckungen — Errungenschaften, welche angethan sind, unsere gesammten gesellschaftlichen Verhältnisse bis in ihre Grundfesten umzugestalten. Da ist der geistvolle Physiker Reis in Frankfurt a. M., er ersann das „Telephon," welches in seiner Urgestalt, vollkommen klar und vollendet in allen seinen Haupttheilen, einen ehrenvollen Platz in der deutschen Abtheilung der pariser Elektricitätsausstellung einnimmt. Die Deutschen bleiben aber einmal nur ein Volk der „Denker" und jedem kaufmännischen Unternehmungsgeiste für praktische Verwendung werthvoller physikalischer wissenschaftlicher Errungenschaften weidlich abgeneigt, und so schlummerte denn mit Reis auch sein Telephon friedlich in der Erde, bis vor ca. 3 Jahren der Amerikaner Graham Bell plötzlich das Reis'sche Telephon zu vollen Ehren brachte, und mit seinen Neuerungen und anerkennenswerthen Fortschritten versehen, sich den Ehrenpreis der „Erfindung" im Betrage von 20,000 Frcs. bei der Akademie zu Paris im vorigen Jahre einkassirte und somit das Telephon dem öffentlichen Verkehr für immer überlieferte. Da ist ferner der deutsche Erfinder Dr. W. Siemens, dem das Glück freilich ausnahmsweise einmal nicht den Rücken wendet. Siemens verstand es kluger Weise, sich bald mit einem thätigen Geschäftsmann zu verbinden, und so haben wir denn hier eine ganze Reihe der wichtigsten elektrischen Erfindungen nur von diesem einen Manne zu verzeichnen.' Wir erinnern nur an den „Differential-Regulator," ferner an seine Methode, „Gold und Silber galvanoplastisch niederzuschlagen," an seine „Zeiger- und Druck-Telegraphen" mit Selbstunterbrechung, erste Verwendung der Isolation durch „Guttapercha," „unterseeische Minen," „dynamo-elektrische Maschine" 2c. Vor Allem aber ist es die Verwendung der elektrischen Kraft als Ersatz der „Dampf-Locomotive" der Eisenbahnen, die wir Simens verdanken. Hier stehen wir an der Pforte eines neuen, machtvollen Zeitalters, dasjenige der „Elektrischen Eisenbahnen." In noch höherem Grade, als die Verwendung des Dampfes zur Fortschaffung der riesenhaften Güterzüge und Eiltrains für Personenförderung in diesem halben Jahrhundert stattfand, wird der elektrische Strom Eingang im gesamm[ten Gebi]ete des

Eisenbahnverkehrs finden. Die außerordentlich hohen Vortheile, die großen Annehmlichkeiten, die wir bei Anwendung der elektrischen Kraft zum Betriebe der Eisenbahnen erzielen, sind von solch' hervorragendem Grade, daß die „Sicherheit" des reisenden Publicums und der Comfort in demselben Maße zunehmen werden, als die Betriebs- und Anlagekosten der Bahnen sich vermindern. Heute bereits, in der kurzen Spanne Zeit von wenigen Monaten seit Erfindung der elektrischen Eisenbahn, vermögen wir Waggons mit 50 Personen in großer Schnelligkeit, wie solches hier in den Champs-Elysées täglich geschieht, zu befördern. Alle Viertelstunde fährt ein solcher Waggon, durch Elektricität getrieben, vom Ausstellungspalast nach dem Place de la Concorde.

Die elektrische Kraft schafft aber nicht allein die Menschen auf horizontaler Bahn mit Windeseile fort, sondern hebt sie auch in die höchsten Etagen in den elektrischen Aufzügen von Siemens empor. Eine derartige Anlage wird in diesen Tagen im Ausstellungspalast fertig gestellt und dürfte nach Art derjenigen zu Frankfurt a. M. hierselbst großes Interesse finden. Durch das Wasser wird der Mensch jetzt ebenfalls mit Elektricität geschafft: dem Nachfolger des Dampfschiffes, Mr. Trouvé mit seiner elektrischen Gondel, verdanken wir diese geniale Idee. Mr. Trouvé fährt allabendlich unter allgemeinem Beifall des Publicums in einem großen Bassin des Centrums der Elektricitätsausstellung in seiner elektrischen Gondel einher. Keine Anstrengung, kein Rauch, kein Dampf, nichts als der winzige schwache Strom von ein paar Elementen, welcher die kleine Schiffsschraube durch geeignete Transmission bewegt. Daß wir aber auch nicht allein auf dem Lande und im Wasser, sondern auch in der „Luft" von nun an mittelst Elektricität reisen werden, und der Lösung des brennenden Problems der allgemeinen Aëronautik hierdurch um einen bedeutenden Schritt näher gerückt sind, dafür hat Mr. Tissandier gesorgt, dessen elektrischer, fischähnlicher Ballon hoch oben in der Luft des Palastes kreist. — Wir finden auf der pariser Ausstellung eine ganze Maschinenwerkstatt von Hobel-, Bohr-, Drehmaschinen für Eisenbearbeitung, Alles getrieben durch eine einzige elektrische Maschine. Wassermassen in großer Quantität hebt hier ebenfalls der elektrische Strom, ganz in derselben Weise, jedoch nur umgekehrt, wie wir durch das Herabstürzen von Wassermengen (Wasserfälle oder Wehre der Ströme und Flüsse) uns die elektrische Kraft erzeugen.

Nähmaschinen, Plissirmaschinen, Kreissägen, allerhand landwirthschaftliche Arbeitsmaschinen ꝛc., alle diese Functionen werden heutigen Tages spielend und „geräusch-, rauch- und geruchlos" bewältigt von der kleinen elektrischen Maschine.

Die Idee, das Licht hörbar zu machen, sehen wir in jenem interessanten Experimente vor uns, bei welchem Glasröhren von verschiedener Länge und Oeffnung, über eine brennende Wasserstoffgasflamme gehalten, bestimmte anhaltende Töne hervorbringen. Faraday sah als Ursache dieser Erscheinung die Entstehung sehr vieler kleiner plötzlicher Explosionen von Knallgas, welches sich bekanntlich bei Mischung von Wasserstoffgas mit atmosphärischer Luft in bestimmten Verhältnissen bildet, an. Die Verbindung der beiden Probleme, den Schall sichtbar und das Licht hörbar auf elektrischem Wege zu machen, führte Graham Bell zur Construction seines sinnreichen „Photophons," jener praktischen Verwendung der Eigenthümlichkeiten des seltenen Seeleumetalls. Wir vermögen Wärme in Licht, Licht in Wärme, Elektricität in Licht, Wärme in Elektricität zu verwandeln und sehen in den neuesten elektrischen Entdeckungen einen ferneren Beweis für das mächtige Gesetz von der Energie der Natur, jenes unendlichen Kreislaufes der unzerstörbaren lebendigen Kraft, welche hier im Gewande dieser und dort in jener Erscheinung unseren menschlichen Sinnen wahrnehmbar wird, jenes scharfsinnige Gesetz, welches der erst vor drei Jahren verstorbene deutsche Arzt und Naturforscher v. Mayer zu Heilbronn aufstellte und bewies. — Frédéric Kastner hat das Faraday'sche Experiment weiter verfolgt und mit seinem „Lustre chantant" wiederum die Reichhaltigkeit der Anwendung des elektrischen Stromes von Neuem dargethan. Der Lustre chantant oder „Singender Kronleuchter" oder das „Pyrophon" von Kastner ist auf die Eigenthümlichkeit gegründet, daß Flammen unter gewissen Bedingungen, wie oben erwähnt, Töne erzeugen, wenn sie sich innerhalb eines Rohres und an einem bestimmten, mit der Länge und dem Durchmesser des Rohres wechselnden Punkte des Rohres befinden. Unter Benutzung des Umstandes, daß der Werth des Tones vom Durchmesser der Röhre abhängt, ist es Kastner gelungen, die Noten der Tonleiter in mehreren Octaven zu erhalten. Die Töne dieser Flammen haben Aehnlichkeit mit den Orgeltönen, doch sind sie viel lieblicher und harmonischer. Die erste größere öffentliche Probe dieses Pyrophons fand bereits vor zwei Jahren im Cursalon zu Baden-Baden mit voller Orchesterbegleitung statt.

Seit Humphry Davy im Jahre 1815 den ersten elektrischen Lichtbogen darstellte und die Entdeckungen Wheatstone's, Faraday's, Siemens und Anderer die Verwendung der magnet-elektrischen und dynamo-elektrischen Maschine zur Erzeugung von elektrischem Lichte nachwiesen, ist unsere öffentliche Beleuchtungsperiode aus dem Zeitalter des „Steinkohlen-Leuchtgases" in dasjenige der „Elektrischen Beleuchtung" übergegangen. Frei muß man bekennen, daß wohl zu nichts der elektrische Strom sich vortrefflicher eignet, als grade zur „Beleuchtung." Die Fähigkeit der Elektricität, eine sehr große Anzahl Lichtquellen, welche sich in bedeutender Entfernung von einander befinden, plötzlich gleichzeitig aufleuchten zu lassen, ferner die äußerst geringe Wärmestrahlung des elektrischen Lichtbogens, die scharfe Erkennbarkeit und Unterscheidung von fernen bunten optischen Signalen bei elektrischem Licht, so wie der Umstand, daß hier kein oder doch sehr wenig Sauerstoff verbraucht wird, alle diese Eigenschaften sind, abgesehen von der beliebig bedeutend hohen Lichtintensität, welche wir durch Elektricität erzielen können, bei der Auswahl einer Beleuchtungsmethode sehr schwer wiegend und sichern der Elektricität auf dem Felde der Beleuchtung für lange Zeit ihre ausgedehnteste Verwendung. Die elektrische Beleuchtung, wie sie heute bereits in vielen Tausenden industriellen, gewerblichen und commerciellen Etablissements, in Theater-, Concert- und Vergnügungslocalen, großen Magazinen, Eisenbahnhallen ꝛc. Anwendung findet, datirt im großen Ganzen erst seit der Eröffnung der letzten großen pariser Weltausstellung des Jahres 1878. Vorher verwandte man das elektrische Licht fast ausschließlich nur zu Leuchtthürmen, großen öffentlichen Bauten oder dergl. Heute zählen wir auf der pariser Elektricitätsausstellung ca. 50 verschiedene elektrische Beleuchtungssysteme, welche entweder offenes elektrisches Licht zwischen zwei Kohlenspitzen, den „Volta'schen Lichtbogen" oder „Glühlicht", auch „Incandescenz" genannt, vertreten. Da sind die Systeme von Gramme, Jablochkow, Brush, Serrin, Duboscq, Foucault, Sautter u. Lemonier, Rollet, Planté, Faure, Meritens, Reynier, Debrun, Siemens, Piette-Krizik, Gerard, Jall, Werdermann, Kyfe, Weston, Jamin, Jaspar, Edison, Swan, Maxim und Lane Fox ꝛc., welche alle mit einander wetteifern, und, je nach der Eigenthümlichkeit ihres Systems, entweder sich besonders in dieser oder in jener industriellen Richtung oder Raumesgröße qualificiren. 50 große elektrische Lichtquellen von ca. 30 bis 40 Gasflammen Lichtintensität strahlen allabendlich von beiden Seiten der imposanten Gallerie des Palastes, in matte, große Glaskugeln gehüllt, ihr schönes Licht herab, während im Centrum der Ausstellung der mächtige hohe, von anmuthigen Felsengrotten und sprudelnden Cascaden umgebene Leuchtthurm allabendlich bunte elektrische Drehlichter in Stärke von 3000 Kerzen in die weitesten Punkte sendet. Die Firma Siemens u. Halske hat in der deutschen Abtheilung zwei mächtige reich vergoldete Candelaber, deren jeder eine elektrische Lichtquelle von 250 Gasflammen Intensität tragen, aufgestellt. Außerdem hat die Americain-englische Gesellschaft „Brush" am Ausgange des Palastes 40 elektrische Lichter von circa 150 Gasflammen Intensität in matte Glasglocken exponirt, die alle, getrieben von einer einzigen dynamo-elektrischen Maschine in einem Stromkreise functionirend, ein sehr angenehmes und dabei sehr helles Licht entwickeln. Die Gesammtzahl aller elektrischen Lichter der unteren Räumlichkeiten, so wie der oberen Salons der Gallerien wird sich auf ca. „3000" belaufen. Glühlichtflammen nach dem System Edison befinden sich allein in zwei Salons ca. 1000. Swan hat Glühlichter im Congreßsaal ca. 500, so wie in dem anstoßenden Restaurant 150 und den unteren Abtheilungen ca. 100 vorgeführt, und findet diese Beleuchtung mittelst Incandescenz der Glühlichtsysteme Edison, Swan u. Maxim allabendlich den lebhaftesten Beifall des Publicums. Diese letzteren Systeme eignen sich besonders für kleinere Räumlichkeiten, Wohnzimmer und dergleichen, und besitzen eine Lichtintensität von 8 bis 16 Normalkerzen. Das Glühlicht ist vollkommen ruhig, flackert nicht im mindesten, verursacht kein Geräusch, giebt keinen Verlust durch Anwendung matter Glocken, und macht überhaupt auf das Auge einen überaus wohlthuenden und angenehmen Eindruck. Jede einzelne Flamme läßt sich beliebig anzünden oder ausdrehen mittelst eines kleinen Wirbels ähnlich den Gasflammen.

Was die Dauer des dünnen, im luftleeren Raume der kleinen Glühlichtglaskugeln glimmenden

Kohlenfadens anlangt, so soll sich dieselbe auf 1/2 bis 3/4 Jahr belaufen und würde dies natürlich ein sehr günstiges Resultat sein. Edison richtet sein Glühlichtsystem zum gleichen Preise wie Leuchtgas bereits in Städten ein. Sämmtliche Apparate, Transmissionen, Leitung des elektrischen Stromes durch den Kupferdraht in langen unterirdischen Röhrenleitungen, Photometer &c. &c. hat Edison in seinen beiden Sälen in reichster splendider Weise dem Publicum vorgeführt. Er benutzt jetzt als Glühlichtmaterial einen haardünnen Faden von japanischer Bambuskohle, deren Darstellung in zwei großen anschaulichen Tableaux Zeugniß von dem Arbeitseifer des Erfinders des „Phonographen“ ablegen. Ihm ist entschieden die Ehre der Autorität als Erfinder der Incandescenz-Beleuchtung zuzusprechen und seinen Nachfolgern Swan, Maxim und Anderen keine weitere Bedeutsamkeit beizulegen.

Die Elektricitäts-Ausstellung ist des Morgens von 8 bis 6 Uhr ununterbrochen und des Abends von 8 bis 11 Uhr bei völlig entfalteter elektrischer Beleuchtung dem Publicum geöffnet. Einen seltenen Genuß gewährt es, wenn man des Abends schon von weiter Ferne den spitzen Obelisken von Luxor auf dem Place de la Concorde, grell vom stärksten elektrischen Lichtstrahl getroffen, hell auf dunkelblauem Grunde aufblitzen sieht und, näher an den Palast schreitend, die geisterhaften riesengroßen Lichtreflexe des Leuchtthurms und der elektrischen Wiege von Serrin in wunderlichen Formen und Schwingungen vorbeiziehen sieht. Drinnen aber im Ausstellungspalast flimmert und flammt es überall gleich einem Meer von schimmernden, strahlenden Feenkronen und Candelabern. Hier ein Kranz von wunderbar röthlich scheinenden Lichtern, dort ein Flammenstrahl in stahlblauer Farbe, dort apfelgrünes Schillern, alle möglichen, denkbaren Lichtreflexe empfangen in diesem Wunderbau der „Elektricität“ den Beschauer. Arago, der große Physiker und Naturforscher, dem im Verein mit Ampère, Galvani, Weber, Otto v. Guericke, Franklin, Faraday, Oersted, Ohm, Volta, Thales v. Milet und Jacobi hier im Palais de l'Industrie von Lorbeeren umwobene Gedenktafeln errichtet sind, sagt mit vollem Recht:

„Wer in der heutigen Zeit etwas für unmöglich hält, der entbehrt der Vorsicht und Klugheit!“

E. Hinkefuß.

1735

COMPTES RENDUS STÉNOGRAPHIQUES

Assemblé General

16 Nov

BANQUE CENTRALE
DU
Commerce et de l'Industrie

1736

(Société anonyme)

Capital social : 25.000.000 francs

Siège social provisoire : 2, rue Blanche
— définitif : 27, rue de la Chaussée-d'Antin.

Deuxième assemblée constitutive du 9 novembre 1881

Présidence de M. Charles Porgès

La séance est ouverte à trois heures.

M. Ch. Porgès, fondateur de la Société, est élu président à l'unanimité.

Les deux plus forts actionnaires présents, MM. H. Bamberger et J. Stern viennent l'assister comme scrutateurs.

Le bureau, ainsi constitué, désigne M. A. Bénard pour remplir les fonctions de secrétaire.

M. le Président constate que la feuille de présence indique que plus de la moitié du capital social est représenté à la réunion et que l'avis de convocation a été inséré, conformément à la loi, dans les numéros du journal le *Droit* et des *Petites Affiches*, en date du 4 novembre courant. L'assemblée générale est donc régulièrement constituée et peut valablement délibérer.

M. Bénard, l'un des commissaires nommés à la précédente assemblée, donne lecture du rapport qu'il a été chargé de faire sur les avantages accordés par les statuts au fondateur de la Société ainsi qu'aux membres du conseil d'administration.

(Les conclusions du rapport, tendant à l'approbation des avantages réservés par les statuts au fondateur et au conseil d'administration, sont adoptés à l'unanimité par l'assemblée.)

M. le Président met successivement aux voix les résolutions suivantes, qui sont également adoptées à l'unanimité :

1° L'assemblée générale nomme, dans les termes des statuts, membres du conseil d'administration :

MM. Sébastien de Neufville, fils,
Cyprien Girerd,
Marcellin Pellet,
Parent,
Charles Porgès, fondateur de la Société.

(Ces messieurs déclarent accepter les fonctions qui leur sont conférées. — Acte leur est donné de leur acceptation.)

2° L'assemblée générale fixe à 50.000 fr. la valeur totale des jetons de présence attribués au conseil d'administration ;

3° Elle nomme en qualité de commissaires, chargés de faire le rapport sur le prochain exercice social, MM. Bénard et de Schnapper, qui acceptent ;

4° Elle fixe à la somme de 1.500 fr. pour chacun l'indemnité desdits commissaires ;

5° Elle approuve, dans leur entier, les statuts de la Société, tels qu'ils ont été rédigés et imprimés ;

6° Considérant que toutes les actions sont libérées de moitié, l'assemblée générale décide que lesdites actions seront délivrées au porteur ;

7° Considérant que toutes les formalités prescrites par la loi ont été scrupuleusement remplies, l'assemblée générale déclare définitivement constituée la Société de la *Banque centrale du commerce et de l'industrie.*

M. le Président prend ensuite la parole et s'exprime ainsi :

Il me reste, messieurs, à vous dire quelques mots sur ce que nous avons déjà fait et sur la marche que nous comptons suivre dans la direction de la Banque centrale du commerce et de l'industrie.

Je tiens d'abord à bien constater que nous voulons faire des affaires et non de la politique. Nous avons la bonne chance de compter parmi nos administrateurs quelques hommes politiques justement estimés, qui sont venus à nous pour nous aider à faire des affaires et non pour nous mêler aux questions qu'ils savent bien traiter dans une autre enceinte. Il est vrai cependant que nous sommes tous républicains, tous partisans du gouvernement actuel, tous amis du progrès et des lumières. Aussi notre première œuvre a-t-elle pour but d'éclairer le monde (sourires), c'est-à-dire d'exploiter les brevets de M. Edison pour l'application de l'électricité à la production de la force motrice et de la lumière. Ces brevets, nous allons les exploiter sur tout le continent européen, excepté au Portugal et en Suède. L'organisation de Sociétés de ce genre est très compliquée à cause des divergences considérables qui existent entre la législation de l'Amérique et la nôtre ; les négociations ont été laborieuses mais nous sommes enfin parvenus à trouver une formule qui donne satisfaction et à M. Edison et à nous-mêmes.

Sans entrer dans les détails de nos opérations futures, je puis vous dire que nous avons l'intention de fonder trois Sociétés. L'une, qui portera le titre de *Compagnie continentale Edison*, sera chargée de la mise en valeur des procédés de cet inventeur dans tous les pays pour lesquels nous sommes autorisés à traiter. A cet effet, des Sociétés particulières seront fondées à Vienne, à Berlin, à Rome, à Madrid, en un mot, dans toutes les principales villes d'Europe, avec participation de notre Société dans les bénéfices. La somme d'un million, qui constitue la première mise de fonds, n'est pas très considérable, mais, vous le savez, de petits commencements conduisent souvent à de grands résultats.

Cette affaire, je ne vous le cache pas, est de son essence même assez aléatoire, mais en nous entourant de toutes les précautions possibles, en n'agissant qu'après mûr examen des rapports que nous ont présentés nos ingénieurs, nous croyons que nous ne pouvons aboutir qu'à d'heureux résultats. L'éloge des inventions de M. Edison n'est plus à faire, mais enfin d'autres inventeurs peuvent trouver mieux. En mettant toutes les chances contre nous, il n'y aura jamais qu'un million de perdu dans lequel notre Banque n'entrera, si le conseil d'administration accepte ma proposition, que pour 50.000 fr. — (cinquante mille.) D'après les calculs approximatifs, il y a grande chance pour que ces 50.000 fr. — produisent un revenu annuel d'environ pareille somme.

L'intérêt total de la Banque dans les trois Sociétés ne dépassera pas la somme de 175.000 fr.

La seconde de ces Sociétés sera une Société de fabrication dont les usines, établies dans le voisinage de Paris, auront pour directeur M. Bachelor, l'un des collaborateurs principaux de M. Edison. Aucune Société rivale ne sera placée sous la direction d'un ingénieur aussi rompu aux affaires, d'une expérience pratique aussi consommée, — car il a suivi, dès le début, les études de M. Edison et dirige, depuis deux ans, à New-York, des Sociétés similaires, — je crois donc que lors même que certains procédés Edison, seraient tombés dans le domaine public, ce que nous contestons absolument, notre Société aura encore une supériorité marquée sur les Compagnies qui exploitent l'application de l'électricité à la lumière.

Enfin, la troisième Société, — cette multiplicité de Sociétés peut sembler extraordinaire, mais il y a à New-York cinq Sociétés du même genre et concourant, comme les nôtres, au même but, — la troisième Société aura pour objet la création d'établissements isolés destinés à éclairer de grands magasins de nouveautés, des gares, des imprimeries, etc. On peut, dans ces établissements, placer immédiatement des machines sans avoir besoin de l'autorisation municipale pour les travaux de canalisation. Aussi cette dernière Société sera-t-elle la première à fonctionner. Nous avons déjà un nombre considérable de demandes de divers établissements, parmi lesquels je puis citer le *Bon Marché*, l'imprimerie de la *Petite République française*, le foyer de l'Opéra, etc.

Il me semble, messieurs, en avoir dit assez pour vous montrer que ce n'est pas là une affaire ordinaire et qu'elle présente des chances sérieuses de bénéfices. Maintenant, quant à la marche que nous comptons suivre dans la direction générale de notre Banque, je puis, je crois, me dispenser de dire qu'elle sera très prudente. Vous savez comment je dirige depuis longtemps mes propres affaires et combien je suis ennemi des aventures.

Nous avons encore certaines chances de bénéfices qui ne sont pas à dédaigner. Nous avons le bonheur de compter parmi nos plus forts actionnaires des administrateurs de la *Banque de Paris*, du *Comptoir d'escompte*, de la *Société générale*, de la *Banque franco-égyptienne*, et qui, sans avoir pris d'engagements, ne manqueront pas, je l'espère, lorsqu'ils auront fait fait une bonne affaire, d'y faire participer notre jeune Banque.

Je ne veux pas, messieurs, abuser plus longtemps de votre attention et si personne ne demande la parole, je vais lever la séance, persuadé que vous emporterez tous d'ici l'impression que vous venez de vous associer à une affaire qui a des chances sérieuses de réussite.

La séance est levée à quatre heures un quart.

1737

1738

L'ÉCLAIRAGE EDISON

— Les visiteurs de l'Exposition internationale d'électricité à Paris, au Palais de l'Industrie, deviennent de plus en plus nombreux, depuis surtout que l'exposition est ouverte le soir. Les globes électriques auxquels le public est accoutumé déjà sur les boulevards, les places publiques, dans quelques grands ateliers, éclairent la grande nef et quelques salles des galeries. La véritable nouveauté, celle autour de laquelle la foule curieuse s'empresse chaque soir, est l'éclairage par les lampes à incandescence.

En réalité, un système seul réunit les conditions d'une industrie pratique, c'est celui de M. Edison. Quelques inventeurs ont bien exposé des lampes, mais leur installation, encore à l'état rudimentaire, ne peut constituer que le sujet d'expériences de laboratoire.

M. Edison a créé au contraire un éclairage industriel, se pliant à tous les besoins, prenant toutes les formes; tantôt celles les plus gracieuses, les plus riches de nos appartements les plus élégants; tantôt les formes les plus simples de nos plus humbles demeures.

Dans son exposition, les lustres resplendissent sous les plafonds à côté des lampes courant autour des murs comme de simples becs de gaz s'allumant et s'éteignant comme eux, séparément, à l'aide d'un commutateur semblable à un robinet. Ses lampes sont montées sur des branches fixes, ou sur des branches articulées tournant et se développant comme celles du gaz; d'autres sont portatives avec la forme de nos chandeliers.

On pourrait s'étendre à l'infini sur les applications générales du système Edison, appelé, dans un temps très rapide, à se substituer dans les usages domestiques à tous les systèmes employés aujourd'hui. Aussi est-il intéressant d'en examiner les détails afin de s'assurer qu'il répond à toutes les nécessités pratiques.

Disons d'abord que sa lampe n'est qu'une partie de ce système, partie essentielle il est vrai, mais qui resterait inapplicable si elle n'était alimentée par une canalisation électrique, merveilleuse de simplicité et

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SAUVEGARDES CONTRE L'INCENDIE

DANS LE SYSTÈME EDISON D'ÉCLAIRAGE A LA LUMIÈRE ÉLECTRIQUE

Après s'être intelligemment rendu compte de la chaleur produite par les grands courants électriques qui sont nécessaires dans un système général d'éclairage à la lumière électrique, M. Edison s'est aussitôt mis à la recherche de moyens efficaces pour prévenir les accidents qui pourraient résulter d'une augmentation soudaine et anormale du courant dans ses conducteurs, et partant, empêcher une augmentation de leur température au delà du point de sûreté absolue. C'est lui qui a trouvé ces moyens et qui a pris d'autres précautions, en renfermant les conducteurs des rues dans des tuyaux en fer et en les mettant sous terre; en se servant dans l'intérieur des maisons tant que cela était praticable, de la même sorte de conducteurs renfermés dans les tuyaux en fer des rues et, où il n'était plus praticable de s'en servir, en adoptant une espèce d'isolant non combustible, mais d'une qualité très durable. Nous pensons pouvoir le démontrer clairement par la description suivante de ses méthodes et systèmes.

SYSTÈME GÉNÉRAL.

L'invention de M. Edison se distingue de toutes les autres tentatives à l'éclairage par la lumière électrique, par son étendue et par la manière parfaite dont elle est systématisée, tant en général que dans ses plus petits détails.

Au lieu de placer de la force à vapeur et les machines électriques dans chaque construction à éclairer, comme on avait fait par le passé, il établit une station centrale pour fournir chaque kilomètre carré de la cité. Cette station est absolument à l'épreuve du feu et contient

d'ingéniosité. Cette canalisation est rattachée à la machine dynamo-électrique de M. Edison actionnée par une machine à vapeur. Elle court sous les rues, le long des trottoirs, sous les égouts, décrivant toutes les courbes comme une véritable tuyauterie. La canalisation principale se compose d'une barre ronde de trois pouces de diamètre environ, en matière isolante à bon marché, traversée par deux conducteurs en cuivre demi-rond d'environ un pouce de diamètre. Cette barre, qu'on peut allonger indéfiniment, pénètre aux carrefours des rues dans des boîtes de jonction à trois, quatre, cinq ou six pans, d'où elle ressort dans toutes les directions à desservir. Les conducteurs pénétrant dans les maisons, d'un diamètre moindre que les précédentes, se greffent sur la ligne principale, dans une boîte plus petite, au moyen de vis et de pattes d'attache qui en rendent le montage et le démontage faciles. Ils se transforment ensuite en fils de 2 millimètres ou 3 millimètres de diamètre dans les appartements, toujours d'après le même principe, c'est-à-dire partant d'une boîte de jonction dont la grandeur décroît, comme le diamètre des conducteurs, en raison de l'importance de sa fonction.

Dans chacune de ces boîtes sont interposées dans les courants des armatures de sûreté en plomb. On sait que la tension du courant peut s'accroître de façon à développer une haute température dans les fils, occasionner leur rupture et un dégagement de chaleur suffisant pour communiquer le feu aux objets environnants. Ce fait s'est produit à l'exposition d'électricité, dans la salle de la bibliothèque éclairée par d'autres lampes que celles de M. Edison. Les fils se sont rompus par suite d'une trop forte tension du courant et ont mis le feu à la cloison. Cet accident n'est pas à craindre dans le système de M. Edison, par cette raison que les armatures de sûreté en plomb placées non seulement dans les boîtes de jonction, mais aussi dans les patères des lampes, fondraient sous l'influence d'une haute température et que le courant serait immédiatement interrompu.

Outre ces précautions, le système Edison est pourvu d'un régulateur enregistrant toutes les oscillations du courant, et permettant de répartir l'électricité au fur et à mesure des exigences de la consommation. Les fortes tensions peuvent donc être écartées et avec elles les dangers d'incendie.

L'inventeur en déployant un tel esprit, une telle science des nécessités pratiques, démontre que le savant, chez lui, est doublé d'un ingénieur distingué. Comment ne pas en être frappé par l'examen de ses lampes, rendues indépendantes les unes des autres par une ingénieuse disposition de leurs patères d'attache aux murs, par les fils de sûreté disposés aussi dans chacune d'elles, par les contacts habilement ménagés dans les articulations des branches, et qui permettent de les tourner à volonté. Ce sont tous ces détails qui constituent le système Edison,

car comme nous le disons plus haut, la lampe, sans eux, ne serait pas encore sortie du domaine de l'expérience de laboratoire.

M. Edison a su la plier aussi aux nécessités pratiques. Voici de quoi elle se compose : un globe de verre de la forme et de la grosseur d'une poire ordinaire avec un filament de charbon en ∩ rattaché à deux fils de platine. Le vide a été fait dans le globe. Sa partie inférieure est fermée par un disque isolant pourvu de deux anneaux de cuivre où sont soudés les deux fils de platine. C'est par ces deux anneaux, dont l'un porte un pas de vis, que s'établissent les contacts avec les fils de l'extérieur. Le courant est-il établi qu'une douce lumière jaillit autour du filament de charbon; elle n'a pas l'aspect blafard, polaire, de celle qui tombe des globes des places publiques, elle a un éclat doré au contraire, très doux aux yeux.

Chaque soir, dans les salons occupés par l'exposition de M. Edison, les curieux s'extasient sur les reflets que les lustres mettent sur les tableaux ou les tapisseries suspendus aux murailles et qui permettent d'en scruter les moindres détails. On sort un livre de sa poche, un journal, une feuille quelconque ; on se livre à des expériences de lecture, et il n'y a qu'une voix pour demander à M. Batchelor, l'organisateur intelligent de l'exposition Edison, le collaborateur et l'ami du savant américain, de répandre au plus tôt dans le public, les trésors dont il dispose.

Ce sera chose rapidement faite, car les avantages du système Edison sur l'éclairage au gaz, à l'huile, au pétrole, sur toutes nos lampes fumeuses à odeur âcre, s'affirment d'une façon trop évidente. L'électricité ne donne pour ainsi dire que de la lumière. On peut tenir dans la main le globe de verre où elle brille douce et pure, sans ressentir autre chose que de la tiédeur : donc pas de chaleur. D'odeur non plus, puisque le verre est clos et que le charbon demeure incandescent dans le vide. Sous ce rapport, les inconvénients des autres systèmes nous sont trop connus pour que nous prenions la peine de les énumérer.

Au point de vue économique, nous sommes en mesure d'affirmer que le prix de la lumière Edison ne dépassera pas celui du gaz. M. Batchelor monte en ce moment des générateurs de vapeur au Palais de l'Industrie pour se livrer à des expériences économiques. Le charbon qui y sera brûlé pour alimenter la machine à vapeur actionnant une machine électrique devant alimenter 500 lampes Edison, sera exactement pesé. La quantité consommée sera ensuite comparée à celle utilisée pour produire une quantité égale de lumière du gaz. M. Batchelor est convaincu que le résultat sera favorable à la lumière électrique.

Nous aurions encore bien des choses à dire sur le système Edison. Nous nous contentons aujourd'hui de mettre sous les yeux de nos lecteurs les dispositions essentielles de ses organes afin d'en faire ressortir

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ce qui les intéresse le plus, c'est-à-dire ses qualités absolument industrielles et pratiques.

Il est en voie d'application à New-York, où des compagnies l'exploitent. A Paris, M. Batchelor organise les ateliers où vont être fabriquées es machines, les canalisations et les lampes destinées à l'éclairage des habitations et des établissements industriels de divers quartiers.

4300. — Imprimerie A. Lahure, rue de Fleurus, 9, à Paris.

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dans ses murs toute la force à vapeur et les machines électriques nécessaires à la fourniture de toute la lumière, ainsi qu'une portion considérable de la force dont on n'a pas besoin pour le moment, mais qui pourra être nécessaire à l'avenir, après la disparition absolue de tous les becs de gaz, lampes à huile ou bougies en usage actuellement.

Cette disparition complète de la méthode d'éclairage par la « flamme » est une affaire d'une telle importance pour les intérêts des Sociétés d'assurances que nous appelons votre attention tout particulièrement sur ce point.

La substitution de petits moteurs électriques aux nombreuses petites machines à vapeur en si grand usage dans les manufactures de lumière fait disparaître une cause permanente d'incendie et d'explosion; elle mérite par conséquent la même attention. Les moteurs électriques consistent simplement en un aimant électrique: aucune armature tournante, aucun cylindre ni chaudière n'est nécessaire dans le local; le courant qui s'opère est fourni par la même source que la lumière, et par les mêmes conducteurs.

Nous avons par conséquent, une concentration, pour ainsi dire, de tous les germes de feu dispersés en si grand nombre sur un kilomètre carré de la cité, et cette concentration est opérée dans une construction spéciale, qu'il est possible et praticable d'assujettir à une surveillance intelligente et continue.

Recherchons maintenant jusqu'à quel point nous introduisons de nouveaux éléments de danger à la place de ceux que nous faisons disparaître.

Nous avons la manufacture du courant électrique renfermée dans un bâtiment; de là, nous envoyons un élément capable de produire une chaleur anormale et le feu par conséquent, si les précautions nécessaires ne sont pas prises pour le prévenir. Le sujet se résume naturellement sous les rubriques suivantes :

SYSTÈME EXTÉRIEUR OU DES RUES.

Tous les conducteurs de cette force électrique qui est, pour ainsi dire, « dehors », consistent en deux fils ou barres en fer convenablement isolés l'un de l'autre par un isolant spécialement composé. Les deux barres, avec la substance isolante qui les contient, sont placées dans un seul tuyau en fer, lequel tuyau est posé afin d'être protégé, à environ deux pieds sous terre; les différentes sections de ce tuyau sont réunies dans une boîte en tôle dite : « Boîte de jonction »; ainsi, chaque pied des conducteurs « extérieurs » est renfermé dans un tuyau en fer continu et mis sous terre. Concevoir une méthode plus efficace

pour assurer l'immunité du feu qui pourrait provenir de l'usage de ces tuyaux serait une tâche des plus difficiles.

Cependant, nous démontrerons un peu plus loin qu'une sauvegarde additionnelle et nouvelle a été adoptée par M. Edison.

SYSTÈME INTÉRIEUR OU DES MAISONS.

Ayant transmis le courant en parfaite sûreté de sa source de production à un point immédiatement contigu d'une maison quelconque, nous allons expliquer maintenant comment la pose des fils est effectuée dans cette maison et comment on fournit chaque bec ou lampe.

Le « fil principal de service » consiste en un tuyau pareil à ceux des rues et réuni aux tuyaux des rues dans une boîte de jonction; puis il est posé dans les caves ou sous-sol de la maison en passant au-dessous des trottoirs. Le bout, à l'intérieur de la maison, passe alors dans un compteur et de là à tous les étages qu'il faut éclairer. Les jonctions sont faites sur chaque étage par des boîtes de jonction convenablement disposées pour fournir les conducteurs de l'étage. Ainsi le système des tuyaux des rues est appliqué jusqu'aux étages supérieurs des maisons.

SYSTÈME DES PARQUETS OU DES MURS.

Comme il est impraticable de porter plus loin les conducteurs renfermés dans des tuyaux en fer, il devient nécessaire d'avoir recours aux fils isolés ordinaires du commerce, c'est-à-dire des fils isolés par une ou plusieurs couvertures de fil de coton tressé et bien serré sur le fil en cuivre, et bien imprégné d'un quelconque des divers composés isolants, connus des manufacturiers. Comme ces composés sont pour la plupart, très inflammables, M. Edison les a abandonnés et en a adopté d'autres qui sont non combustibles: c'est donc avec ces fils isolés non combustibles que l'extension du système des maisons est effectuée.

Les deux fils qui forment le circuit sont maintenant séparés l'un de l'autre par un espace d'environ deux pouces et, en continuant cette séparation, sont posés sur tous les étages, plafonds et murs, de la maison à la base de chaque fil à alimenter.

Un nombre suffisant de supports sont placés pour maintenir cette séparation et pour empêcher tout contact des fils avec les tuyaux de gaz ou autres substances métalliques. En dehors de ces supports, et afin de protéger, d'une manière permanente, les fils de toute fatigue et de toute usure, et en même temps afin que le travail ait une apparence convenable, du bois arrondi et troué d'un côté pour recevoir le fil, est placé

au dessus de chaque fil dans toute son étendue et soutenu dans sa position par une vis posée dans le mur ou le plafond. Par ce moyen, le déplacement des fils par la tension est prévenu, et la possibilité de se toucher, ainsi que les apparences disgracieuses si souvent rencontrées dans les autres circuits électriques, disparaissent complètement.

JONCTION..

De la base de jonction des fils sont renfermés dans des tuyaux de fer ou de cuivre, selon que les fils sont enfilés dans les tuyaux de chaque jonction, à tous les becs ou toutes les lampes qui en dépendent.

Nous connaissons maintenant le système entier des conducteurs depuis les stations centrales jusqu'à chaque bec ou lampe dans la cité et trouvons chaque longueur renfermée dans une « enveloppe » incombustible. Cependant nous n'avons pas encore parlé de la protection la plus importante et efficace du système. C'est avec intention que nous l'avons laissée pour la fin, afin de pouvoir en donner une explication plus complète.

Pour arriver à la comprendre, nous devons d'abord rechercher les causes qui produisent une chaleur anormale dans les conducteurs; l'énonciation de quelques faits nous est nécessaire pour cela.

1°. Chaque lampe demande une certaine quantité d'énergie électrique pour la vitaliser, en rapport avec la quantité de lumière qu'elle doit produire.

2° Pour produire de la lumière, il faut de la chaleur, et pour obtenir de la chaleur il faut offrir une barrière au libre passage du courant.

Ce résultat est obtenu en plaçant sur le chemin dn courant un conducteur d'une faible capacité, c'est-à-dire d'une forte résistance : ce conducteur est le filament de charbon que nous voyons à l'intérieur de la lampe Edison. La résistance qu'il offre a pour résultat de lui donner une grande chaleur, même jusqu'au point de l'incandescence : ainsi nous produisons de la lumière.

3° L'économie du courant demande que l'énergie électrique soit transmise de la source d'où elle est fournie jusqu'à la lampe sans perte aucune; c'est-à-dire sans être gênée dans son passage dans les conducteurs. Cela à son tour exige que les fils conducteurs aient une capacité de transmission qui permette le libre passage du courant; c'est-à-dire qu'ils n'offrent aucune résistance appréciable au courant. Pour cela, un métal d'une grande force conductrice étant nécessaire, c'est le cuivre qui est employé.

Cependant, quand une quantité suffisante a été employée pour transmettre librement le courant aux lampes qui doivent être fournies, l'éco-

nomie demande alors qu'on n'use plus de cuivre; par conséquent, nous avons des conducteurs gradués proportionnellement à l'importance de la fourniture à faire et qui varient en grandeur depuis le tuyau de section le plus considérable des rues jusqu'au fil le plus insignifiant qui nourrit une seule lampe.

Ainsi, dans tout le système nous rencontrons ce fait, la résistance à la transmission du courant se trouve toute entière dans les lampes, conséquemment c'est là, et là seulement que le travail se fait. La fourniture de l'électricité est conservée, bien entendu, en harmonie parfaite avec les exigences des lampes à alimenter. Cependant, s'il était permis de l'augmenter, le seul effet serait d'augmenter la lumière. Si elle était augmentée d'une manière anormale, l'effet serait de surcharger les filaments de charbon et de les détruire, auquel cas le courant dans ce circuit serait arrêté instantanément, car l'électricité ne peut pas se transmettre dans un circuit interrompu. Par conséquent, tant que la proportion de la résistance des conducteurs aux lampes est maintenue, il n'est pas possible qu'il survienne des accidents. Mais si, par un accident tel que la détérioration d'une enveloppe isolante amenant la jonction de deux fils, ou leur communication avec une substance métallique, qui les avoisine, le circuit est complété du conducteur plus fort, ainsi introduit accidentellement; ce conducteur plus fort offrant beaucoup moins de résistance à la transmission du courant, la quantité de celui-ci augmente d'une manière anormale, dont l'importance est égale à la fusion de cette portion du circuit qui peut offrir *pour le moment* (en l'absence d'une lampe) la plus grande résistance.

Si cela était, ce qui est probable, les petits fils en cuivre au point du contact, deviendraient trop chauds et se fondraient; si c'était le métal par lequel les deux fils sont réunis accidentellement, alors, il y aurait fusion. Dans l'un ou l'autre cas, une chaleur anormale égale à la production du feu est le résultat. La première substance appelée à sentir l'effet de la chaleur, sera, bien entendu, l'enveloppe isolante du fil; si elle est inflammable, la chaleur excessive y mettra le feu. Si elle n'est pas inflammable, le seul résultat sera de la carboniser. Ainsi, il est important d'avoir un isolant non inflammable sur les fils, semblable à celui qui a été adopté par M. Edison. Il est cependant plus important encore de prévenir toute augmentation anormale de courant et par conséquent de la chaleur et fusion des fils. Pour assurer ce résultat, M. Edison a inventé et se sert d'une nouvelle méthode.

Le principe est d'établir dans chaque circuit, sans exception, *un point faible*, qui doit être, bien entendu, convenablement placé, tant pour pouvoir le réparer et le préserver de toute interruption ou dommage.

Nous avons expliqué comment le courant est concentré au point de la plus haute résistance, c'est-à-dire sur le conducteur le plus faible.

Ordinairement, c'est la lampe, mais afin de protéger les conducteurs ainsi que les maisons qu'ils traversent pour arriver à la lampe, il est nécessaire d'établir un autre point dans le circuit où toute tendance à un courant anormal opérera une interruption instantanée du circuit et par conséquent arrêtera tout courant. Ce point, se trouve naturellement à l'autre extrémité du circuit alimentant la lampe, c'est-à-dire au point où le circuit particulier part de sa source.

On verra facilement que si ce point est établi, toute jonction accidentelle des deux conducteurs allant à la lampe s'y manifestera et supprimera tout courant au point de jonction accidentelle, empêchant ainsi l'échauffement des fils.

La méthode par laquelle cette protection automatique est obtenue est d'interposer dans le circuit, comme partie du conducteur, une petite pièce de métal, de préférence du fil en plomb, possédant moins de force conductrice que les conducteurs ordinaires en cuivre et proportionné de manière à transmettre sans fusion le courant strictement nécessaire pour alimenter la lampe ou les lampes sur son circuit. On verra que, comme le plomb a beaucoup moins de force conductrice que le cuivre et se fond par une chaleur beaucoup moindre, il se fondrait et ouvrirait le circuit avant que les fils en cuivre n'aient été influencés d'une manière appréciable. Cette pièce de fil en plomb servant de régulateur est placée bien entendu dans un endroit accessible aux employés de la Compagnie.

Ces régulateurs sont placés à chaque jonction d'embranchement avec sa source, qu'elle soit dans le socle de la lampe, du lustre, à l'entrée de la chambre, à la boîte de jonction, sur le parquet, au compteur, ou a la jonction du tuyau de service avec celui de la rue. Ils affectent le système entier des rues et terminent seulement à la machine génératrice dans la station centrale. Ainsi, partout où un contact accidentel peut arriver, il a immédiatement derrière lui un de ces régulateurs de sûreté pour protéger la propriété devant lui et les lumières en arrière.

En résumé, nous trouvons le système Edison ainsi protégé :

1° Système extérieur entièrement renfermé dans une armure en fer.

2° Système des maisons renfermé dans un isolement non inflammable et protégé aussi par des enveloppes substantielles et durables.

3° Un régulateur de-sûreté absolue, agissant en vertu d'une loi immuable, pour supprimer instantanément l'énergie électrique sur un point où se produit l'accident.

4° La concentration dans un bâtiment non combustible de toutes les sources d'incendie, explosion, etc. etc., etc., dispersées actuellement sur chaque kilomètre carré de la cité.

En terminant, nous appelons l'attention sur le tuyau des rues et les

fils d'installation employés dans les maisons par la compagnie Edison. Les tuyaux de service dans les maisons sont pareils à ceux des rues; ils diffèrent seulement de grosseur.

Edward H. Johson

pour la Cie Edison.

A messieurs les Administrateurs des Sociétés d'assurances contre l'incendie de New-York.

4298. — Imprimerie A. Lahure, rue de Fleurus, 9, à Paris

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EPREUVE

EXPOSITION INTERNATIONALE D'ÉLECTRICITÉ

UNE REVOLUTION DANS L'ÉCLAIRAGE

On reproche souvent au public de se laisser séduire par les objets qui frappent ses sens plutôt que sa raison. Si ce reproche a jamais été justifié, c'est certainement par ce qui se passe à Paris, à l'Exposition d'électricité. Jamais nos yeux n'ont été inondés de pareils torrents de lumière, aussi, elle seule absorbe-t-elle la plus grande partie de l'attention de la foule. Chacun sent, en entrant dans la grande nef du Palais de l'Industrie, où des milliers de globes versent leur lumière blanche, que l'électricité s'empare définitivement du domaine occupé jusqu'ici par le gaz et les autres agents d'éclairage.

Ce sentiment cède bien vite la place à une persuasion raisonnée, lorsqu'on monte dans les galeries éclairées par les lampes à incandescence. C'est là, où cette révolution s'affirme, qu'elle prend un caractère tout à fait pratique, définitif, avec les appareils exposés par l'illustre savant américain Edison.

Sa lampe avec son filament de charbon incandescent y brille sur des lustres, des chandeliers portatifs, des candélabres, des branches pivotantes comme celles du gaz. La lumière est produite dans un globe de verre de la grosseur et de la forme d'une poire ordinaire, dans lequel on a fait le vide. Ce globe est fermé à sa partie inférieure, avec un tampon de matière isolante, garni de deux anneaux de cuivre contre lesquels sont soudés les fils conducteurs de l'intérieur. Cette disposition la rend d'un usage plus simple, plus pratique que n'importe quelle lampe d'un autre système. On peut la poser aisément sur le premier

support venu; il suffit de mettre les deux anneaux en contact avec un circuit électrique extérieur et la lumière resplendira.

Elle a l'éclat et la couleur d'un bec de gaz, avec cette différence qu'elle ne modifie pas les couleurs, qu'elle n'incommode pas la vue et qu'elle ne dégage aucune fumée, aucune odeur, puisqu'elle brille dans un globe fermé. La chaleur produite est si faible qu'on peut tenir le globe à pleine main, sans éprouver autre chose qu'une sensation de tiédeur.

Disons cependant, que la lampe Edison ne pourrait pas devenir d'un usage général, sans l'ingénieuse canalisation qui l'alimente. C'est cette canalisation, pour la réalisation de laquelle M. Edison a déployé les ressources de ses connaissances à la fois théoriques et pratiques, qui permet de résoudre les derniers éléments du problème de l'éclairage domestique par l'électricité.

Elle se compose de trois parties : 1° la canalisation principale; 2° la canalisation des immeubles; 3° la canalisation des appartements.

La canalisation principale est formée de deux barres de cuivre demi-rond, rattachées aux pôles de la machine dynamo-électrique, et isolés par une sorte de gutta-percha à bon marché, enveloppée dans un tube en fer rond de cinq centimètres de diamètre. Cette barre se place dans la terre, sous les rues ou dans les égouts.

La canalisation des immeubles est semblable à la précédente, mais avec un diamètre plus petit, et se place sous les trottoirs et le long des murs principaux.

La canalisation des appartements est formée de deux fils isolés par une enveloppe de coton incombustible.

Les jonctions des canalisations entre elles, se font dans des boîtes ou avec des armatures disposées pour conserver l'indépendance de chaque direction. Cette indépendance est assurée, même pour chaque lampe, à ce point que, si un accident se produit à l'une, il n'a aucune conséquence pour sa voisine.

M. Edison a interposé aussi, dans le circuit électrique, des fils de plomb qui fondraient et interrompraient le courant dans le cas où une haute température se dégagerait par suite d'une tension trop élevée. De cette façon les dangers d'incendie sont complètement neutralisés.

Un compteur, formé d'un vase rempli d'une solution métallique est mis à la disposition de chaque consommateur. Le courant décompose la solution et le métal qui tombe au fond du vase est pesé à la fin du mois. On sait ainsi quelle quantité d'électricité a été dépensée.

Ce sont tous ces détails qui constituent le système Edison, et le rendent immédiatement applicable. A New-York, des quartiers entiers sont déjà éclairés à la lumière Edison; à Paris, où les demandes des consommateurs affluent pour l'obtenir, on s'occupe d'organiser les usines où les conduites, les lampes et les machines électriques doivent

être construites. M. Batchelor, le collaborateur de M. Edison, qui dirige ces travaux en France, déclare que la lumière sera livrée aux consommateurs au même prix que le gaz.

Des démarches ont été faites pour que le système Edison soit appliqué à bref délai en Allemagne.

4395. — Imprimerie A. Lahure, rue de Fleurus, 9, à Paris.

THE EXHIBITION OF ELECTRICITY.

After a literally brilliant career of more than three months, the International Exhibition of Electricity has closed its doors. By the terms of the decree which originated it, the closing ought to have taken place on November 15, and this date would certainly not have been exceeded, if the early days of winter had not been of unusual mildness, for the Palais de l'Industrie possesses no appliances for internal warming. Fortunately, the exceptionally fine weather favoured an extension of five days, and gave an opportunity for carrying out a work of benevolence which worthily crowned this great and prolonged fête of science. The receipts obtained from the visitors during the days and evenings of November 16, 17, and 18 have been divided into two parts, one of which was handed to the treasury of the service for the public aid of the poor of Paris, and the other part was employed to reward the zealous labours of the Exhibition staff, the attendants in the telephonic salons, the engineers and drivers of the syndicate. They thus benefitted by the division of a net sum of 26,000 francs, the total having been swelled by the curiosity of tardy visitors, and by the establishment, entirely too late, of some special telephonic performances, to which the visitors were admitted by payment. Whilst the ordinary public telephonic auditions of two minutes' duration, dearly paid for by tedious waiting, sometimes for hours, were carried on in two of the rooms, special admissions for five minutes, and by payment of five francs, were also at last started. In this way, during November 16, 17, and 18, no less than 6000 francs, representing 1200 visitors, were obtained. During the days and evenings of Saturday 19 and Sunday 20, the public were admitted free to the palace, and 78,000 persons took advantage of this privilege.

The closing weeks of the Exhibition were rich in fêtes and banquets, at which the Minister, the commissioner-general, the syndical chamber of electricity, did honour to the juries, and to the foreign commissions, and at which, it is needless to say, much eloquence and enthusiasm for electricity and its practical application abounded, and where much honourable pride and mutual congratulations were expressed concerning the result of the labour of so many heads and hands. The Electrical Exhibition has indeed been a great and legitimate success. Firstly, a financial success, which is always a matter of importance, and especially so in the present instance, for with a wise prevision, the organisers of the Exhibition devoted, in advance, all profits accruing, to the assistance of one or several scientific works. And what more logical and more useful purpose could the surplus serve, than in the creation of a national museum, library, and laboratory of electricity? Such an institution would be a fitting monument to the first International Electrical Exhibition, and would be one that all the world would applaud. This monetary success is the natural consequence of the powerful attraction for popular curiosity that the Exhibition exerted. Truly it was arid enough and too technical, for those minds unfit for and unaccustomed to serious study, for all, or almost all, was new, and often very difficult to understand. But the mysterious prestige of electricity has always been so great that its name alone was a guarantee of attraction which events have fully justified.

The Exhibition was opened on the 4th of August; it was opened to the public in the evenings on and after the 27th of the same month, so that it has lasted 102 days and 85 nights. During August and September the total of paying visitors during the day was 175,000, and as many in the evenings; of these 16,000 were brought by the Siemens' electrical tramway. In October 120,000 attended in the evenings and 80,000 in the day; of these 28,000 arrived by the electric tramway. In November the paying entries were 68,000 and 26,500 respectively, 14,000 having been brought by tramway. With the 78,000 visitors of the two last days, there was thus a total of 675,000 persons who entered the Exhibition, exclusive of exhibitors and their staff, the members of the juries, foreign commissioners and their agents, representatives of the press, and a large number who enjoyed the privilege of free admission. This total of 675,000 corresponds to a total receipt (not including the allowance of 50 centimes per head made to the syndicate) of 580,350 francs, and leaves a clear profit of about 16,000*l*. If the result has been thus satisfactory, we may say in praise of the organisers of the Exhibition that they have known thoroughly how to minister to the curiosity and interest of a vast mass of people, despite the fact that the Exhibition was largely made up of complicated and to the majority incomprehensible apparatus.

The telephonic reproductions of performances at the Opera, have ranked amongst the first and greatest of the attractions. These alone indeed would have secured the success of the Exhibition, for they were a grand revelation of the possibilities of science to the popular mind. Let us add that if the admirable telephones of M. Ader have been able to astonish and delight hundreds upon hundreds of visitors every night, it was to the happy conception and intuitive prevision of M. Antoine Breguet that the results obtained were due. It should not be forgotten that this young and already celebrated electrician made the first suggestion of this application, and the greater share of the credit for the success obtained is due to him. At the same time it must be acknowledged that the nightly pleasure was made painful to the long file of patient visitors who were kept waiting hour after hour until often many had to go away disappointed after losing the whole evening without getting near the telephone room. All this might have been avoided had numbered tickets been previously issued, and if one or two nights a week had been reserved for admission on payment, as was done at the last. We do not know what prevented the General Commission from following a plan that would have given universal satisfaction, and have brought in large returns. It is to be regretted, but at least the fact that curiosity is more powerful than fatigue was amply proved. On the evenings of the Opera performances, the entries were 1500 in excess of other evenings.

The second great popular attraction has been the electric tramway. As we said above, 58,000 visitors took advantage of this mode of transit to enter the Palais de l'Industrie. It may thus be safely assumed that at least 100,000 travelled by it, counting those who left the building on the car. It would be difficult to over-estimate the pleasure afforded to the masses in travelling for a very small sum, in a vehicle progressing apparently by its own volition. It would occupy too much space to refer to all the striking curiosities that helped to make the Exhibition a success—telephonic conversations, electrical pianos, electric shocks, sewing machines driven by electricity, electrical toys, electrical pens, electrical bells making perpetual inharmonic music, and above all the marvellous illuminations from fifty different systems, and superior in brilliancy, in extent, and in power to anything that had ever been seen before.

Thanks to all these and many more attractions offered to the public, a great number of persons, the majority of whom were certainly ignorant of the first principles of physics and of electricity, have acquired a general familiarity with things to which, without the Exhibition, they would have long remained strangers. Obliging cicerones were not wanting, too often it is true more obliging than instructed; and it was to be noted that the current coin of explanation, freely circulating in the building, had not been struck at any scientific mint. But the fact remains that the great public made the acquaintance of electricity, the application of which the Exhibition has popularised. The public has seen the mysterious force at work, and in some degree has measured its power. It is no longer a stranger, and on the day, which we may reasonably think is near, when it will commence wide competition with other sources of energy, the public will be with it, and not against it. Above this lower level, engineers, manufacturers, and physicists have found in the Exhibition for the first time the opportunities for a general and profound study of its special subject. Public conferences were organised and repeated almost daily; professional associations strengthened them; the public séances of the Congress, and of the Industrial Reunion of Electricians completed them. Books, pamphlets, documents of all kinds have been always within reach of any one, both in the well-supplied reading-room, and at the numerous bookstalls in the building, and these have greatly facilitated investigation. As for professional electricians, the Exhibition has been for them a more admirable field for study than they could have dreamed of. Until then, isolated one from another, small groups only could be found in each country. The Exhibition brought them together, made them personally acquainted with each other, and from this intimate association of men of science following the same investigations, enthusiastic over the same pursuits, has been evolved, thanks to the séances of the Congress, a general and promising good fellowship, and a sort of international freemasonry, the advantages of which to science must be considerable.

By the almost unlimited facilities and cordiality extended to foreign delegates, France showed herself, as ever, the same generous and hospitable nation. She has had the good fortune to take the first step on a road of progress which leads—as one of her most illustrious children, the venerable M. Dumas, has said—to a great industrial revolution, to the epoch of electricity, and we may freely accept the prophecy coupled with such an illustrious name. The impulse to which France has this year given so great a movement has already begun to realise the prediction.

The part played by this country at the Exhibition calls for notice here.

There cannot be any doubt that Great Britain entered this great international competition under very disheartening circumstances. Repudiated and neglected by their Government, and without any official organisation, the few contributors who first promised their support to the Exhibition were naturally disheartened and humiliated in the disadvantageous position in which they were placed by the apathy of the Government, but the Society of Telegraph Engineers and of Electricians, and the Council of the Society of Arts came to the rescue, and so far brought to the recognition of the Government the fact that the International Electrical Exhibition at Paris would in all probability prove itself to be far more important than they had anticipated, and that to leave it altogether unrecognised by the administration would be a slur both upon the Government and upon the country. The result of this was that Her Majesty's Government did what would have, if it had been done at first, saved the country much reproach; they appointed the Earl of Crawford and Balcarres, F.R.S., to be Chief Commissioner for Great Britain to the Exhibition, and Lieutenant-Colonel Webber, R.E., Sir Charles Bright, and Professor D. E. Hughes, F.R.S., were nominated as other commissioners, and Mr. John Aylmer (to whose persistent exertions is due the recognition in this country of the importance of the Exhibition) was appointed the honorary secretary to the Commission.

Notwithstanding the very severe disadvantages under which the non-recognition by the Government of the Exhibition until so late placed the exhibitors, and notwithstanding the still more serious drawback that this tardy official recognition was unaccompanied with any sort of monetary grant, the British Section was a great and triumphant success, and perhaps throughout the whole Exhibition no section has been so much respected and received such honourable attention as that presided over by the British Commission. This overcoming of obstacles and counterbalancing of disabilities, converting them into high-class recognition and producing a great success under such disadvantageous circumstances, is due to the indefatigable exertions, organisation, and general courtesy to every one concerned of those attached to the British Commission. After the British Government had so far recognised the Exhibition by the appointment of a Commission, which was due in the first place to Mr. John Aylmer and the Societies of Arts and of Telegraph Engineers, very heavy work fell upon the Commissioners. During the early days of the Exhibition when the exhibits were being brought in, Lord Crawford and Balcarres personally superintended, and himself assisted in the placing of the various objects in the spaces allotted to them, and in fact for several weeks he took the most active part in the management and carrying on of the section. The necessary funds were supplied by a subscription and guarantee fund raised among the exhibitors, to which others contributed; to Professor Hughes, who was at his post for some fourteen weeks, was assigned the oftentimes difficult and thankless task of making the best of the money supplied by this fund for the purposes for which it was raised, and so judiciously has the fund been disbursed that all the arrangements have been successfully carried out by an expenditure which has left a surplus in the hands of the Commission. During the meeting of the Congress, all the Commissioners were at the Exhibition every day, and for the last fortnight the Commission has been represented by Colonel Webber. Throughout the whole time, however, Mr. Aylmer, the honorary secretary, has been in the Exhibition both day and night assisting the exhibitors in every way and earning for himself an accumulation of gratitude which will be long remembered by both British and foreign visitors to the Exhibition. In recording the labours of those who have contributed to the success of the British Section, the name of Mr. F. H. Webb, the secretary to the Society of Telegraph Engineers and of Electricians, must not be omitted, as in the early days of the organisation, he contributed by labour and by courtesy to the collecting and holding together of those likely to become contributors.

Among representatives of foreign countries much is due to Signor Govi, the Chief Commissioner for Italy, and to Senor Arduña, the Spanish Commissioner, for so actively promoting the success of the undertaking: as well as international good feeling.

The aspect of the Palais de l'Industrie on Sunday night last was one not to be forgotten by any one who was present; the whole building appeared to be literally crammed with people, and although they seemed so close together that it appeared impossible to drop any more between, the great crowd moved along in regular and orderly streams, wondering at the thousand curious objects which formed the Exhibition, and which were illuminated by the rays of a thousand electric lights. And it is a remarkable and interesting fact, and one very characteristic of the love of order of such-like gatherings in France, that there was not a single report made to the police of any sort of theft, or of any injury done to anything in the Exhibition.

At a little before eleven, when the cry of "*On ferme*" announced that the great Electrical Exhibition would soon be closed for the last time, by a preconcerted signal, the steam whistle of every boiler in the place was turned on, all the fire alarms and electric bells were set going, and to the accompaniment of the deafening dim, which lasted till the place was cleared and the lamps extinguished, the great building was closed. No one who was present will ever cease to remember the effect of all the boilers of that great installation blowing off their steam through their whistles together under the arched roof. Words shouted into a listener's ear in any part of the building were absolutely inaudible, for the whole air appeared to be shrieking in every direction, and the effect on the ears lasted more or less for some hours after leaving the building. It was an amusing and not altogether inappropriate finish to an undertaking, the success of which has made itself known in every quarter of the civilised globe, and whose *éclat* will ring in the ears of those who saw it for many years to come.

Before closing this article let us throw a brief glance backwards over the past ten years, and mark a few of the most striking inventions and discoveries that have most largely contributed to the present development of electrical industry. We see first the Gramme machine, from which dates the utilisation of electrical generators, a hundred times imitated, but never yet surpassed. Then the

Jablochkoff candle which gave the first impulse to the electric lighting of to-day, now so rich in many processes, thanks to the labours, amongst others, of Siemens, Brush, Edison, and Swan. Then the telephone of Graham Bell, annihilating distance more effectually, within limits, than the telegraph. Finally, the transmission of power by electricity, to which attention is now being especially turned, which promises well for the future, and which was largely illustrated at the Exhibition by the exhibits of Griscom, Siemens, Gramme, and on an extensive scale and with largely divided currents, by M. Marcel Desprez.

These are the most important of the beginnings which laid the foundation for the Exhibition of the Palais de l'Industrie, and secured for it so triumphant a success, which will bear fruit in the immediate future, and be followed by others probably of greater magnitude and of equal interest. Indeed, scarcely are the doors of the Palais de l'Industrie closed when the project for a similar exhibition has been formed—not the Crystal Palace venture, of which we have already expressed our opinion—but an official exhibition, under official sanction, organised by the leading men of science, and completed, as has been the one just past, by an International Congress of Electricians. We trust that this Exhibition may be held in London in 1883, and we are certain that it will continue worthily the work commenced in France, and be rich in the new inventions and discoveries that the next two years' ardent scientific work of the world will have developed.

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THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.
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THOMAS ALVA EDISON.

THOMAS ALVA EDISON.

AMERICA has long been renowned as the land of mechanical invention; but she has conspicuously distinguished herself during the last few years. This has been largely due to the genius of Mr. Edison, who, by his many remarkable inventions, which it is needless to enumerate, has drawn upon himself and his native country the attention of both the learned or unlearned in the whole world. Mr. Edison is the chief figure amid a perfect host of inventors, great and small, who swarm in the United States; and being also a self-made man, he has been almost worshipped by his countrymen. There was something almost magical in these inventions, which appealed powerfully to the imagination; and when it was known that their author was a self-taught telegraph clerk, who looked a mere boy, it is no wonder that Edison was lionised as he has been. Such a character, like Balsac in fiction or Mademoiselle Bernhardt in art, breaks the commonplace monotony of existence, and lets loose those hidden springs of enthusiasm which are ever ready to welcome anything in the shape of a prodigy.

Thomas Alva Edison was born at the village of Milan, in Erie County, Ohio, on February 11th, 1847, and is therefore nearly 35 years of age. His father was of Dutch descent, and had been in turns a tailor, a nurseryman, and a dealer in land and lumber. His mother, though born in Massachusetts, was of Scotch parentage and a woman of good education, she having formerly been a school teacher in Canada. Indeed, she may be regarded as the sole teacher of her boy, for the two months' regular schooling he received is of no account. Like many other famous men, therefore, Edison was much indebted to his mother.

Like many other famous men, too, Edison, as a boy, was fond of amusing himself alone. He was a great reader, and did not complain about the nature of a book, so long as it was a book of some kind. It is related that he once set himself to read through an entire subscription library, beginning at the bottom shelf, and that he had penetrated several shelves before his project was given up. At ten we find him reading books of chemistry, and when he began the world as a train-boy on the Grand Trunk Railway of Canada and Central Michigan, he littered the empty baggage car, which served him as a store for his fruit and newspapers, with old retorts and bottles of chemicals, which he had picked up at odd times for a few pence.

With the Yankee instinct for "getting on" abnormally developed, he purchased a second-hand printing press, together with a quantity of type, and started a newspaper of his own, entitled, "The Grand Trunk Herald." Of this literary venture he was proprietor, editor, staff, publisher, printer, and devil, in his own person; and it obtained the flattering celebrity of being noticed in the London *Times* as the only paper printed and circulated in a railway train.

During this time he was investigating everything mechanical which came under his notice. He pored over the working of the telegraph, he studied the locomotive, and once ran the train between two stations himself. He also continued his reading, and "Newton's Principia," side by side with "Ure's Dictionary of the Sciences," and "Burton's Anatomy of Melancholy," could have been seen on the news-boy's shelf. He also took to chemical experiments in an evil day for the pursuance of his news business, for one day he accidentally set fire to the baggage-car, and the irate conductor put a summary end to his literary career and his scientific researches, by ejecting him and all his traps, chemicals, fruit, and printing press included, out of the car.

From his first acquaintance with it, the telegraph has exercised a strong attraction over him; and it was a turning-point in his life when, after he had gallantly rescued a child of the Port Clements station-master from being run over on the line, the grateful father undertook to teach Edison how to telegraph.

Edison was meanwhile turning his versatile talents to account as a shoemaker, a trade which he had picked up in some unaccountable way; but the work was distasteful, and he took a situation at Port Huron, Michigan, as a telegraphist.

From this time, for several years, he led the life of a travelling operator, now engaged in Canada, now in Indianapolis, now in Cincinnati, or Louisville, now in Memphis and Boston. Many amusing stories are told of his ready ingenuity and gawky appearance during this period. His mind was now fairly directed towards invention, and he acquired the habit of experimenting and thinking at night, after the duties of the day were over. At Memphis in 1864, we are told, that he devoted himself to the problem of duplex telegraphy, and, after having his studies and ideas frequently ridiculed and discountenanced by his ignorant fellow clerks and masters, he found his way to Boston in 1868, where he met with more encouragement and better success. "In spite of his peculiar fashions of passing his time," says a writer in *Scribner*, "he had become one of the most accomplished operators. He overcame obstacles put in his way on account of a somewhat uncouth appearance, and soon took an important position. He had up to this time dallied with a number of ideas he has since perfected, acquired a beautiful, small, rapid handwriting, as clear as print, and gratified considerably his desire of seeing the world. He had once been on the point of sailing for South America, from New Orleans, but had only been prevented by an accident. A new period commenced for him. Some small things of his succeeded—a dial instrument for private use, a chemical note-recorder, and others, and he began upon a vibratory principle of telegraphing. He commenced a great epoch in one's history—to believe in himself. Up to this time he had not done so. 'I did not think,' he says, 'that I was competent.' He was not successful, however, in an important trial of his duplex system, and was soon again adrift."

He went to New York in a disconsolate mood, and happening to be in the office of the Gold and Stock Company at a critical moment when their indicator was out of order, he repaired the instrument, and secured an engagement with the company. He soon invented a printer of stock which was adopted by the company, and from that time his progress was assured. He was also taken up by

the Western Union Telegraph Company, and retained by both companies at a handsome salary, to give them the first bid for his new inventions. He was now in a position to start a manufactory of his own at Newark, New Jersey, where he made all his gold and stock printers, and employed about 300 men; but the business left him too little leisure for invention, so he sold out and retired to Menlo Park, a new settlement of a few yellow-painted wooden houses on the Pennsylvania Railway in New Jersey, about 20 miles from New York. Here he built a large barn-like structure upon the top of a hillock, and fitted it out as a workshop and laboratory, the workshop being on the basement and the laboratory upstairs. The former is well supplied with tools, lathes, and workmen, who are kept busy making patterns and transforming the inventor's ideas into wood and iron; while the latter is stocked with books, experimental apparatus, and so many chemicals besides that it looks like a wholesale drug-store. He is said to buy a quantity of every new drug which appears in the market, for he does not know how soon he may want it in his experiments; but we suspect that he has a passion for surrounding himself with chemical compounds, just as a bibliophile has a passion for surrounding himself with books. In this laboratory, Edison has everything at his command; he is provided with several skilful assistants selected by himself for their zeal and ability, who are ready to test all his suggestions, and also to offer ideas of their own. He has workmen to make all the instruments and models he may require, and what is more he can give all his time and thought to the work he has in hand. Menlo Park is an inventors' paradise not to be found in any other country; and though this fact tends to lessen our surprise that Edison should have accomplished so much, we ought not to forget that it was his own genius and industry which first created the place. We need not dwell at length on his several inventions, for they have been so frequently cited and published of late, that they are familiar to most electricians. Before the invention of the loud-speaking telephone and the phonograph had enormously extended his fame, Edison was becoming known on this side of the Atlantic as a rising young genius, sure to do wonders in his day, and his gold and stock printer, his electric pen, electro-motograph, and quadruplex system, had given him a solid reputation as an electrical inventor. Then came the invention of the carbon telephone, the phonograph, and microtasimeter, which swelled his fame to world-wide bounds, and finally, as if to inflate it to bursting point, he telegraphed the enthusiastic but rash announcement across the Atlantic in October, 1878, that he had solved the problem of the divisibility of the electric light, and would soon be able to light up our homes by electricity, at a mere fraction of the cost of gas. A year or two has since passed by, and although the letter of the announcement cannot yet be said to have been fulfilled, yet, by dint of ceaseless energy, Edison has gone far towards accomplishing what he anticipated. The exhibit at the Paris Electrical Exhibition shows that he has overcome some of the obstacles in his way, and that he has attained a large measure of success. The invention of the phonograph is undoubtedly one of the most transcendent flashes of mechanical inspiration that ever entered into the mind of a man; and the loud-speaking telephone, with its carbon transmitter and prepared chalk receiver, is one of the greatest marvels ever constructed out of dead matter. On hearing it and examining it, we cannot but wonder at the daring hardihood and patience of invention which has made it what it is.

Edison has taken out in all about three hundred patents. He has been called "the young man who keeps the road to the Patent Office hot with his footsteps." His plan appears to be to patent all the ideas that occur to him, whether tried or untried, and to trust to future labours to select and combine those which prove themselves the fittest. The result is that the great bulk of his patents are valueless in point of practicability; but they serve to fence the ground in from other inventors.

From our illustration, it will be seen that Edison's appearance is youthful in the extreme. "When you go to his house," says a writer, "he may very possibly answer your inquiry for 'Mr. Edison' himself; or, if not, you will be shown into his laboratory, where you will find him among his assistants; and if you try to guess which is Mr. Edison, your best plan will be to select the least obtrusive person in the group. His figure is slight and young-looking, though the face, from its long habit of concentration, has an old look; he has a frank, cordial expression, and, like most men of great powers, can be almost a boy when his attention is turned away from his absorbing interests. But when he is not aroused, he seems to retire within himself, as if his mind had travelled a long way off, and his attention comes back slowly. He has the peculiar pallor of a night worker, and if you stay with him through the night, you will find him as bright at the end of the vigil as at the beginning." His power of work is something extraordinary, it being usual for him to work sixteen hours each day, and at a stretch; as, for example, when he invented the phonograph, he has eschewed sleep for days and nights on end. More than one assistant has already succumbed to the strain of trying to keep up with him.

Mr. Edison is married, and has three children, two boys and a girl, one of each sex being nicknamed respectively Dot and Dash. He is young, and as he comes of a long-lived stock, notwithstanding the severe strain to which he subjects his powers, we may reasonably expect that he will continue to bestow many useful inventions on his age. We can assure him that should he ever fulfil his intention of coming to England, he will meet with a cordial reception from English electricians.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.—The Postmaster-General has arranged with the Crystal Palace Company to exhibit the whole of the instruments now exhibiting at the Paris Exhibition by the British Postal Telegraph Department. In addition, there will probably be shown in actual use several of the best fast-speed instruments employed by the department.

THE ELECTRIC LIGHT.—The Duke of Sutherland has decided upon lighting his residence at Trentham with the electric light supplied by the British Electric Light Company.

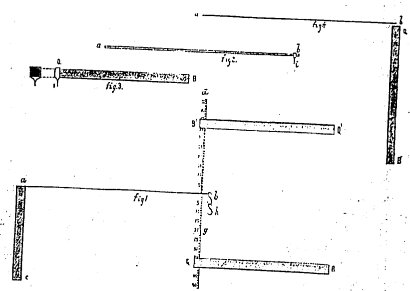
1746

THE PARIS ELECTRICAL EXHIBITION.

FOREIGN SECTIONS.

DR. ANTONIO COSTA SAYA, PROFESSOR OF PHYSICS IN THE UNIVERSITY OF MESSINA.

"MAGNETIC DYNAMOMETER."—The principal part of this instrument consists of two magnets, *a b*, Q B, and a scale, *d g* (fig. 1), arranged upon a rectangular base of wood. The two magnets are placed one above another in such a manner that the axes of symmetry are horizontal and in the same vertical plane. Each of these two magnets carries a very slender index, *i* (fig. 2), I (fig. 3), placed at right angles with the axis of symmetry and in the medium horizontal plane of its thickness.



The first magnet, *a b* (fig. 1), is formed of a long, narrow and thin spring of steel, which is fixed horizontally at one end, *a*, to a perpendicular support, *a c*, and left free at the other extremity, *b*; the latter carries the index, *i*, which by bending *a b* slides along the scale, *d g*; this scale is finely divided into equal graduations, and can be raised or lowered. In order to secure the scale in its exact position before experimenting, the second magnet, Q B, is removed from its support and the scale fixed by means of a set-screw, so that its zero corresponds precisely to the index, *i*, of the spring, *a b*. The plane upon which the magnetic dynamometer is placed during experimentation ought to be very firm and it should not be affected by the oscillations of the floor.

The second magnet, Q B, is placed upon a movable toothed support, by means of which it can be approximated to the other magnet, *a b*, or removed from it. Upon the button of the rack-work is a set-screw to fix the support of the magnet, Q B, at the desired height.

In such an instrument the magnetic attraction or repulsion is counterbalanced by the elasticity of flection. The following experiments will exemplify the method of working the apparatus.

First Experiment.

The magnet, Q B, is removed from its support, and removed so far from the instrument that it cannot act upon the spring-magnet, *a b*; then it can be demonstrated that the inflection of *a b* is proportional to the force which produces it. At *b* there is suspended a very slender copper wire of the form of S for the purpose of lowering the index, *i*, a short distance, *l*, from the scale, *dg*; to the weight there is appended a second one, *h*, of equal weight, so that the index can be lowered to, 2 *l*, and by means of other weights this lowering can be extended to any degree sufficient for the use for which the instrument is intended. If the chain of weights, *b h*, be removed the index will return to the zero of the scale, *d g*. This experiment shows that within certain limits the inflections of the spring, *a b*, are proportional to the force which produces them.

Second Experiment.

The magnet, Q B, is placed upon its support in a direction parallel to *a b*, as is indicated in fig. 1, and in such a manner that its magnetic pole, Q, corresponds to the contrary magnetic pole, *b*, of the spring-magnet, *a b*; moreover it is placed near the scale, *d g*, before which extends the index, I, fixed to a ring. This arrangement enables the index, I, to be placed at a convenient distance from the scale upon which are marked the different heights at which the magnet, Q B, is placed on raising or lowering it.

This being done and the magnet, Q B, being always kept in a parallel position, it is brought to a certain distance from the spring, *a b*, in such a manner as to cause a lowering of the index, *i*; and preserving this, the magnet, Q B, is moved slowly backwards and forwards to find the position which corresponds to the maximum depression of the index, *i*; in such movements the axis of the magnet, Q B, ought not to change its distance from the other magnet, *a b*, nor be removed laterally. When such a position of the magnet, Q B, is found, it is fixed with a set-screw and then the magnetic dynamometer is ready for experiments, by means of which it is demonstrated that magnetic attraction varies inversely as the square of the distance.

Third Experiment.

The magnet, Q B, is removed from the magnet, *a b*, until its index, *i*, marks a slight depression, *l*, and then the corresponding distance, *d*, of the two poles, *a*, *b* (measured from the distance of the two indices, *i*, I), is noted.

This being done the magnet, Q B, is approached to *a b*, it being always kept in the same parallel position so as to reduce to ½ *d* the distance of the two poles, *a b*; it will then be seen that there is a depression of the index, *i*, quadruple that formerly obtained, on 4 *l*. Thus it is shown that the magnetic attraction between the two poles, Q and *b*, varies in the inverse ratio of the squares of their distances. On reducing then the distances of the two poles to ⅓ *d*, the depression of the index will be 9 *l*, or ninefold the first, as it ought to be according to the law in question.

In making such experiments it is necessary to avoid a too close proximity of the magnets, and the first depression, *l*, must be very small.

If it is desired to make a large number of experiments in confirmation of the said law, the following method may be employed.

Fourth Experiment.

Let l, l^1, be equal depressions of the index, *i*; and d d^1, the relative distances of the two poles, Q and *b*, then in accordance with the known law

(1) $$l, d^2 = l^1, d^{12}$$

whence (2) $$d^1 = d\sqrt{\frac{l}{l^1}}$$

Let us suppose that at the known distance, *d*, there is a known depression, $l = 0{\cdot}2$ of the scale by the index, *i*, then (2) we have

(3) $$d^1 = d\sqrt{\frac{0{\cdot}2}{l^1}}$$

If we wish to know the distances, d', d'', d''', &c., of the two poles, *a* and *b*, corresponding to the depressions, $l' = 0{\cdot}4$; $l'' = 0{\cdot}6$; $l''' = 0{\cdot}8$, &c., it is sufficient to substitute for l', in the equation (3) the numerical values of the distances, d', d'', d''', and approximating successively the pole, Q, to the pole, *b*, there are obtained the depressions corresponding to the index, *i*, in conformity with the law above mentioned.

Magnetic Repulsion.

To prove the same law for magnetic repulsion, the magnet, Q B, is placed above *a b*, in the position B' Q' (fig. 1), parallel to *a b*, so that the two homonymous poles, *b* and B, of the two magnets may correspond in the same perpendicular. To the latter is adapted the ring which carries the index, I, laying hold of the pole, Q, which in this new position will correspond to Q'.

By this arrangement of the two magnets, the index, *i*, of the magnet, *a b*, will be depressed by the magnetic repulsion between the two similar poles, B' and *b*. The experiments may be made in the same manner which was employed for demonstrating the law of magnetic attraction.

Distribution of Magnetism in a Magnet.

The instrument in question is useful for studying the distribution of magnetism in a magnet, Q B. For this purpose it is not placed in a parallel position, but in such a manner that the axes of symmetry of the two magnets, *a*, *b*, Q B (fig. 4), may be situated horizontally at different heights, and in two planes, vertical and perpendicular. This position of the magnet, Q B, is called the perpendicular position, to distinguish it better from the parallel position.

Let Q B be placed in the perpendicular position under *a b* (fig. 4) so that the two contrary poles, *b*, *q*, may correspond in the same vertical, and at such a distance as to have a depression of the index, *i*, equal to 9 *l*. This being done, the needle, Q B, is moved very slowly, so that its different sections may correspond successively in the same vertical of the pole, *b*; the index, *i*, will be raised till it returns to zero, and if the movement of Q B is then continued, the index will be pushed in the opposite direction, passing above zero, and rising till the homonymous pole, B, of the magnet, Q B, will be placed below *b*.

A T-shaped support assists in maintaining the magnet, Q B, in the perpendicular position, so that the above-mentioned experiment can be made convenient.

In this and other experiments, it is useful for the magnet, Q B, to be adapted to a scale for better determining the corresponding section, in the same vertical plane, which passes through *b*, when the index, *i*, marks a positive or a negative deviation or none.

Magnetic Actions through Bodies.

It is easy to demonstrate with this instrument that magnetic action is propagated without becoming weakened through many bodies. It is sufficient to interpose the bodies, holding them in the hand, between the poles of the two magnets placed in the parallel position (fig. 1) so as to have a certain depression of the index, *i*. The index will then be seen to remain motionless on interposing between the two poles copper, glass, wood, &c., and to

suddenly change its position if a plate of iron is inserted.

Action of Solenoids upon Magnets.

It will be understood that the dynamometer may give scope for new studies on the reciprocal action between a solenoid and a magnet. It will be sufficient to substitute for the magnet, Q B, a solenoid, both in the parallel and in the perpendicular position.

Electric Dynamometer.

It would be possible to have an electric dynamometer founded on the same principles. It would be sufficient to suspend to the extremity, *b*, of the spring, *a b* (fig. 1), a disc of gilt paper or a ball of elder pith, and charge it with electricity. For the magnet, Q B, must be substituted a rod of varnished glass, which supports at one of its ends another pith ball, which is charged either with the same or with the opposite kind of electricity, according as it is intended to study electric repulsion or attraction. The electric dynamometer must be inclosed in a well-fitting glass case, within which some desiccating substance must be constantly kept. The method of experimenting will be analogous to what has been already described. But special care must be had to take account of the loss of electricity in the interval of time between successive experiments.

The inventor shows that the magnetic dynamometer is preferable to the old instruments for demonstrating that magnetic action varies inversely as the squares of the distances, as well as for other magnetic and electric researches.

Edison.

"Electric Light Apparatus."—The whole system of electric lighting by incandescence, as worked out by Mr. Edison, is of a very ingenious and practical character, and visitors at the Paris Exhibition have every opportunity of seeing for themselves the extent of perfection to which the inventor has brought his original ideas.

The Edison generator, which is of colossal size, and, together with the driving engine, weighs 17 tons, is chiefly remarkable, as regards novelty, for the construction and general arrangement of the armature; the latter differs in many respects from those employed in other machines. This armature, which is shown by figs. 1 and 2 (the latter being a section) is composed in the first place of an iron axis on which is a wood cylinder; the latter is covered by a thick iron tube formed of a series of very thin flat iron discs, separated by paper. This tube is terminated at its extremities by two large iron cheeks, which grip the plates laterally. Arranged longitudinally around the iron cylinder are a number of straight copper bars of trapezoidal cross section, and well insulated from each other by prepared brown paper; these bars take the place of the wire wound on the armatures of ordinary machines. A number of well insulated flat copper rings are strung over the central shaft at each end of the armature; there are half as many rings on either side as there are bars, that is to say, if, for example, there were 50 bars, then there would be 25 rings on either side of the armature. The left-hand rings are connected to the left-hand ends of the copper bars, two bars being connected to each disc, and the arrangement is such that in every case two bars which are diametrically opposite to one another are connected by a ring. The right-hand end of one of the two bars to which we have just referred is connected to a ring on the right hand of the armature, but this latter ring instead of being also connected to the second of the two bars alluded to, is connected to the bar next to it, whilst the opposite end of this third bar is attached to a fresh ring at the other end of the armature, and so on until all the bars have been included in one continuous electrical circuit. The iron core is thus coiled by a continuous circuit formed of the copper bars and rings; these bars and rings being of comparatively large dimensions, the total resistance of the circuit is very small (·008 ohms between the commutator brushes). Moreover, the resistance of the inactive portions of the circuit, namely the copper rings, is very trifling. In the large machine in the Exhibition there are 138 bars in the armature, the active length of each of the bars being 3½ feet. The copper rings are connected to 138 insulated copper sectors, which form a cylindrical commutator of the ordinary form; the contact brushes are arranged in the usual manner. The engine which drives the armature forms part of the whole apparatus and is of 125 horse-power. When the machine runs at a rate of 350 revolutions a minute an electromotive force of about 100 volts is obtained.

One form of dynamo machine (exhibited at the Exhibition) with the Edison armature, is shown by fig. 3; in this machine the inducing magnets are arranged vertically, but in the large machine (shown by fig. 3A) the horizontal arrangement is adopted.

The conductor for conveying the current in the Edison system consists of a metal tube about 3 inches in diameter, containing a cheap insulating substance, and traversed by two half-round copper conductors about an inch in diameter. This main pipe, which can be as long as required, is buried along the main streets, and at the side streets it has derivations branching off, to supply the current to the places it is required to illuminate. The branching off is effected by means of the arrangement shown by fig. 4; this consists of an iron box into which the conductors are led and connected to insulated terminals, to which latter are also connected the branch wires as shown. It will be noticed that the connection of the lower main wire with the right-hand branch wire is not direct, but is made through the medium of a short conductor; this latter is of lead and acts as a safety valve; should, from any cause, the strength of the current flowing out to the branch become too great, then the lead conductor melts and causes a disconnection. The whole box is hermetically sealed up so as to keep the inside perfectly dry. The conductors which are led off into the houses, are of small diameter (about 2 or 3 millimetres) and are joined on to the branch conductors, much in the same way as the latter are joined to the main conductors.

Fig. 5 shows the most perfect form of arrangement of the junction boxes for leading off from the main conductors; the general principle, it will be seen, is similar to that indicated by fig. 4.

The forms, &c., of the Edison incandescent lamps are very numerous. Figs. 6 and 7 show the simplest

arrangement, in which the incandescent carbon is formed by a single horse-shoe. Fig. 8 shows a double horse-shoe, the two being coupled up for "quantity." Fig. 9 also shows a double horse-shoe, but in this case the two are coupled up in "series." In fig. 10 a large surface is obtained by means of four horse-shoes coupled up for quantity, and in fig. 11 a large surface is obtained by employing a long filament coiled into a spiral.

Fig. 12 shows a wall bracket lamp, formed with a single glass bulb, and fig. 13 a chandelier with 3 lamps. A large chandelier with 80 lights is shown by fig. 14. In cases where a folding wall bracket lamp, as shown by fig. 15, is required, special contrivances are necessary to keep up the continuity of the circuit at the folding joints, A and B; the way in which this requirement is effected is shown by figs. 16 and 17, the former also showing the arrangement of the tap for turning the current on and off. Referring to fig. 16, which shows the tap, the object aimed at was a means of breaking the current without causing the disjunction to produce a destructive spark; this object was attained by effecting the break through the interposition of a copper cone which terminated the screw of the tap and which moved away from between two thick copper plates which were in the line-circuit; the continuity being thus broken between two points, both of which had large surfaces, the resulting spark produced but little effect. Fig. 18 shows another form of a tap on the same principle; this tap is provided with a lead safety wire (seen towards the top left hand corner of the figure), which melts if the strength of the current exceeds a safe value. Figs. 19 and 20 show a tap for main circuits: in this case there are three cone pieces, which all move together when the tap is turned, so that the continuity of the circuit is broken at six points simultaneously.

For coal-mining purposes, Mr. Edison has designed the lamp shown by fig. 21; in this arrangement the lamp and connections are kept covered with water contained in a glass vessel, so that contact of the gas in the mine with any part of the lamp likely to become broken is impossible.

In cases where it is required to be able to diminish or increase the light given by a lamp, the arrangement shown by figs. 22 and 23 is employed; this consists simply of a number of carbon bars of different sizes, any one of which can be inserted in the circuit by turning a disc piece (shown separately in the lower part of fig. 23), which makes a contact with the carbon giving the necessary resistance. The whole set of bars are covered by a perforated cylinder (shown in fig. 22), which allows the air to circulate and keep the bars cool.

The regulation of the current strength Mr. Edison effects by means of a system of testing. This arrangement is shown by figs. 24 and 25. Referring to fig. 25, it will be seen that the rheostat, *e*, is in circuit with the inducing magnets of the dynamo machine, A; by this means the action of the latter can be regulated at will by introducing in the circuit referred to, more or less resistance according as the current in the circuit of the lamps is observed to be increasing or decreasing from its normal strength. The resistances of the rheostat are seen in fig. 24 underneath the right-hand table. They are made of thick wire, and are wound on open frames to avoid heating as much as possible.

The testing of the potential of the current in the circuit of the lamps is effected by the help of the apparatus on the left-hand table. The principle of this arrangement is as follows:—Referring to fig. 25, by shifting the two bars of the commutator *j*, over to the left, the battery, D, is connected through a resistance, *i*, of 50,000 ohms, and through the galvanometer, *n*, so that a deflection of the needle is produced, which deflection is brought within readable limits by the shunt resistance, *h*, the latter being connected between the terminals of the galvanometer; the steady deflection obtained represents a definite potential. If now the bars of the commutator, *j*, be shifted over to the right, then the battery, D, is disconnected and the wires, *c c*, connected in their place; then by noting the deflection obtained, the potential of the current passing in the conductors, *a a*, can obviously be obtained in terms of the battery, D. In practice all that is necessary in order to keep the potential in the wires, *a a*, constant, is to keep the bars of the commutator, *j*, over to the right, and then to keep the deflection constant by varying, when necessary, the resistance in the rheostat, B.

Instead of keeping the current constant by the galvanometer observation, this can be done by observing the photometric value of the light obtained from a lamp placed in the circuit; for this purpose the photometer shown by fig. 26 can be employed. By placing the chariot of the photometer at any particular position on the scale, and then varying the resistance in the rheostat, E (fig. 25), it is obvious that any required standard of illumination can be kept up in the lamps on the circuit.

We understand that Mr. Edison's English representative has taken the commanding premises at 57, High Holborn, for the purpose of exhibiting the entire Edison apparatus. Every opportunity will be given for thorough tests of the system being made by those interested in the subject.

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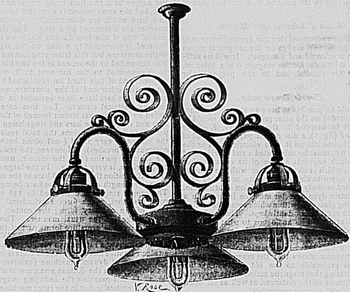

Fig. 13.

Fig. 7.

Fig. 12.—Edison's Exhibit.

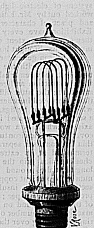

Fig. 10.

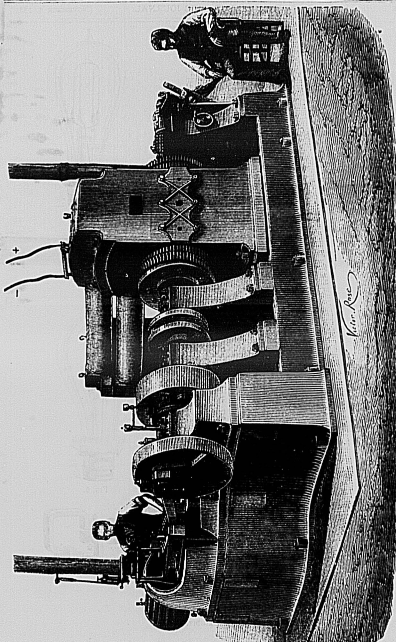

Fig. 3a.—Edison's Exhibit.

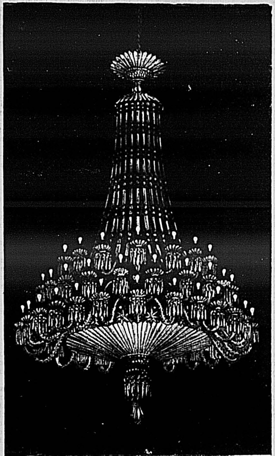

Fig. 14.—Edison's Exhibit.

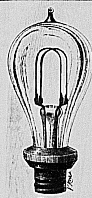

Fig. 8.

Fig. 4.

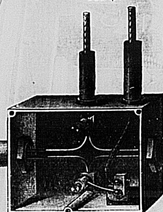

Fig. 9.

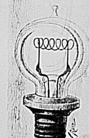

Fig. 11.

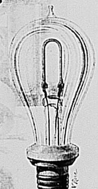

Fig. 6.

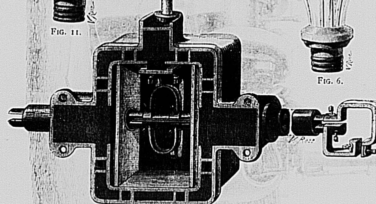

Fig. 5.—Edison's Exhibit.

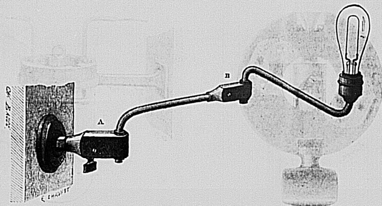

Fig. 15.

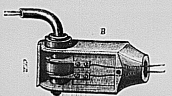

Fig. 17.

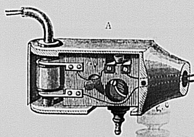

Fig. 16.

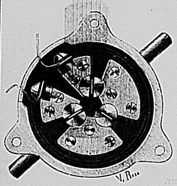

Fig. 20.

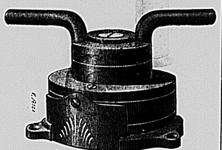

Fig. 19.

Edison's Exhibit.

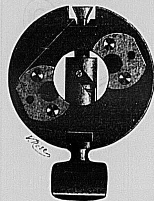

Fig. 18.

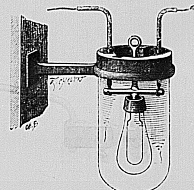

Fig. 21.

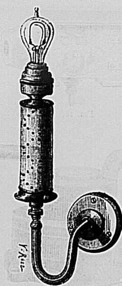

Fig. 22.

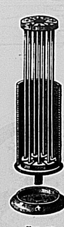

Fig. 23.

Edison's Exhibit.

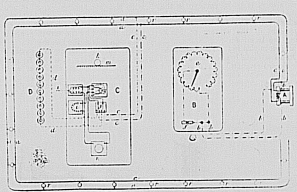

Fig. 25.

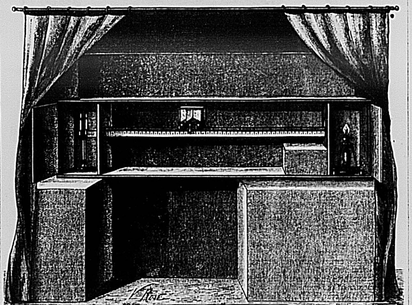

FIG. 26.—EDISON'S EXHIBIT.

The wire thus covered coils itself upon a large bobbin, R, which always tends to revolve in the direction indicated by the arrow by a simple system of clockwork. The bobbin may be rendered independent of the system of clockwork by lowering the lever, *d*.

The motor is shown in plan in fig. 2 and in elevation in fig. 3. On a horizontal base of wood (fig. 2) are fixed the four electro-magnets, *a*, *b*, *c*, *d*, arranged as shown in the figure. Two armatures, g g^1, connected below (in *n*, fig. 3) can each oscillate between planes, so that they may come in contact respectively with the four springs, n, n', n'', n''', each of which communicates by one end with the helix, forming an electro-magnet, whilst the four free extremities are connected by the screw, *l*, which communicates with one pole of the battery.

The current entering in *l* passes by the supports, e, e', to the axle, s, s', which, by means of the commutator above described, at each quarter of a revolution passes it to the electro-magnet, whose wire communicates with the spring touched by the

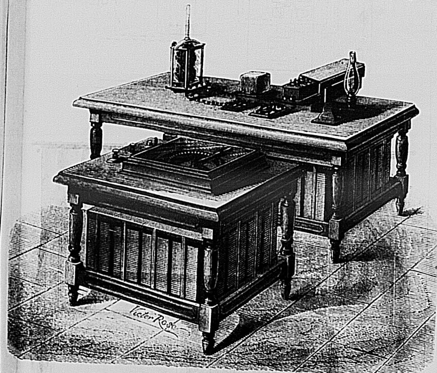

FIG. 24.—EDISON'S EXHIBIT.

the poles of the two electro-magnets as they are alternately attracted. This oscillatory movement of the two armatures is converted into a revolving action by means of the connecting-rods, i i', which are geared to the cranks, s s', of the fly-wheel, V. The wheel, *r*, which is on the same axis as V, has three grooves of different diameters, on which can be fitted the driving cord for the transmission of the movement. The same axle carries the commutator, consisting of two projections soldered upon the axle in two different vertical directions, and in different corresponding projection, so that in a complete revolution of the axle, the current passes successively to the four electro-magnets, causing the two armatures, g, g', to oscillate, and by means of the connecting rods, i, i', to set the wheel, s, s', in rotation.

This arrangement of the motor seems preferable to the one usually adopted, since it combines efficiency with simplicity. In fact, the current does not pass simultaneously into the different coils as in other motors of this kind, but passes successively and without any deviation in such a manner

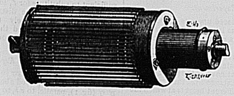

FIG. 1.

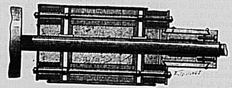

FIG. 2.

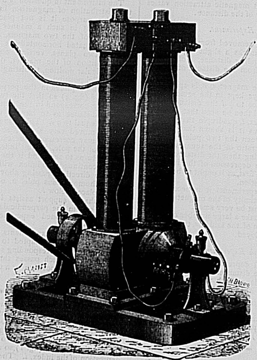

FIG. 3.—EDISON'S EXHIBIT.

that the electro-magnet acquires the maximum magnetic force. It will be easily understood how the above system may be adapted to three electro-magnets instead of four, arranged in three pairs. The axle will then be fitted with three springs, and the commutator will be formed of six springs and three projections, so as to convey the current to each coil at each sixth part of a revolution. By this arrangement greater power and more regularity would be obtained.

But the entire apparatus, as just described, does not satisfy the condition that it should work without requiring any supervision. It might easily happen that a breakage of the silk thread or the exhaustion of one of the bobbins should occur. In these cases it is necessary that the apparatus should stop automatically. This object is attained in the simplest manner by means of a mercurial interrupter, K (fig. 1). This is formed of an electro-magnet, *a*, which can draw down the lever, *m*, by attracting the armature fixed to it. The lever carries on its other arm two iron screws, *n*, *n'*, the ends of which plunge into two small cups of mercury; of these screws, *n* is always in contact, whilst the other comes into contact only when the lever is depressed. When the lever is in this latter position, the electric current before arriving at the motor passes through the two cups of mercury, as the apparatus is in action, until the circuit is closed by the metallic arch terminating in the two screws, but at the moment when it enters into action the electro-magnet, *a*, presses down the lever, *m*, on the side of the screw, *n'*, separating it from the mercury, with which it was in contact, and by breaking the circuit, brings the motor to a stand.

It remains to be shown how the current passes in the electro-magnet, *a*, when a thread of silk is broken.

On the disc, N, N', it will be seen that the thread of silk coming from the bobbin, *h*, after having passed through the orifice, *x*, enters first at *o* into another orifice made in the end of the rod, *n*, which when it is free, is pressed by a slender spring, always kept in contact with a metal disc, V.

There are four rods corresponding to the four silk threads (for the sake of clearness, only one is shown in the figure) which communicate through the entire body of the machine with one pole of the battery, whilst the disc, V, communicates with the other pole, including the electro-magnet, *a*, in the circuit.

As long as all the silk threads pass through the rods, they are all drawn away from the metal disc, V, and therefore the circuit is interrupted; but if one of the threads fails and leaves its respective rod, the latter comes in contact with the metal disc, the circuit is closed, and the electro-magnet, *a*, exerts its action, and brings the motor to a stand.

In order that the circuit may remain open when the apparatus is not in use and thus the waste in the battery be stopped, a mercurial interrupter is included in the last circuit, and the lever, *m*, is placed in unstable equilibrium by means of a screw, *g*. Thus the electro-magnet, *a*, fulfilling its office,

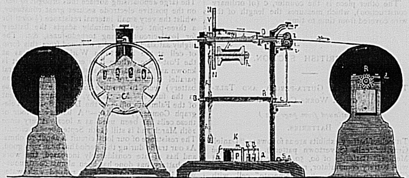

FIG. 1.

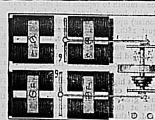

FIG. 2.

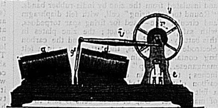

FIG. 3.

interrupts the circuit simultaneously without turning the lever backwards.

To render the apparatus as complete as possible, two other pieces have been added which, though not indispensable, are of great advantage, especially when the machine has to work for a lengthened period.

The first of these is an electric bell, which is intended to give notice when a silk thread is broken, and that the machine has suspended its work. This is done by means of a little column, *p*, added to the interrupter, x, which plays the part of a commutator, and causes the current to pass from the motor to the bell; the latter will then sound until some one comes to open the circuit, which is done by means of an interrupter, *s*.

The other piece is the counter, c (of ordinary construction), which measures the length of the wire covered from time to time.

1749

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Stockholder

Finance, Railways, Mining and General Indu

Vol. XX. No. 6.—Whole No. 968. NEW YORK, TUESDAY, NOVEMBER 15, 1881. P

1950

ECONOMIES IN ELECTRIC LIGHTING WHICH PROMISE GREAT PROFIT —THE NEW MUTUAL COMPANY.

The success of electric lighting is fully demonstrated. The value of the new field of investment thus opened our readers will have inferred from facts recently made public through this paper in respect to the progress of the earlier organized companies.

What has been in doubt was the economy of this method of producing light as compared with gas. Doubts in that respect are removed by recent improvements. By the inventions of Mr. Long, under which the the Mutual Electric Light Company, of New York, is working, it is establipsed that the world can have cheap electricity. Two things indispensable to electric lighting are the lamp and the generator to make electricity. The Mutual Company announce; first, that they will sell their lamp at half the price of any other; second, that the generator made by them can be furnished at a like reduced price, and third, that the light thus produced is in candle-power forty per cent. in excess of that demonstrated under the workings of any other patent.

These are most important points. They are full of significance as respects investment in the field of electric lighting. That that system of illumination is an established success scientifically has been everywhere admitted. The question of its economic use remained open. How far would it displace lighting by gas? It would unquestionably be the light of luxury. In hotels, theatres and places in cities where the profit drawn from liberal revenues not only permits but counsels generous expenditure for whatever is attractive, electricity, it was demonstrated, would be henceforth the method of illumination. Cost is the last consideration in such places. They can afford to vie with each other as to which shall have the best light and the most of it.

But how far down into the region of the middle class customers was this light to extend? There the question of cost is the controlling one. The power needed to engender electricity for lighting is necessarily expensive. It may be made by engines driven by steam or other power on the spot where used, as in one system of lighting. Or, as in another system, the electricity may be supplied through conductors from a certain point where it is generated by engines of enormous power. For instance, in the latter case, as was stated in this paper a few weeks ago, six engines, of one-hundred and thirty-five horse power

each, are provided for the supply of one district of area of perhaps one-half of a square mile.

For local use, another company operating in New York City furnish engines for generating electricity which cost from $300 to $2,400 each. These engines are driven by steam power. Steam power imports outlay for fuel. This apparatus and expenditure suggest the question how extensively electric lighting would come into use by such conditions, and it is at this point that the improvements of the Mutual Electric Light and Supply Company command attention. Their generators of equal power, as has been said, may be profitably sold at half the cost of those referred to above, while the light produced is forty per cent. stronger. These two points, covered in the inventions owned of the Mutual Company, are well said to determine the problem of cheap electricity. They make possible its use by great mass of customers for light who will take the electric light when they are sure it can be had as cheaply as gas. The prospectus of the Mutual Company mentions one case, a public building, where the bill for the month of October last, with electric lighting, was only $380, whereas the bill for October the year before, when gas was used, was $1,144. Extend this economy to consumers by the thousand, and even the hundred thousand, as it is proposed to by the lessened cost under the Mutual Company's patents, and enormous profits ensue from moderate royalties. In the organization of companies in other places the royalties are commuted into cash payment and stock at the outset, and thus large revenues accrue to the parent company in addition to the receipts from its business in New York City.

The Mutual Company is organized upon a moderate basis of share capital, $500,000, in 200,000 shares, of $2.50 each, par value. The company is offering a portion of this stock at par, subscriptions to be made at the company's office, 37 Wall street, or at the office of Messrs. Townsend Cox & Co., bankers, 52 Exchange place. Forms of application for stock will be furnished by Messrs. Cox & Co., or the secretary of the company, Mr. Percy N. Lawrence, through whom, or to Messrs. Cox & Co., checks, &c., must be made payable. Applications must be accompanied by the full amount of the subscription.

The United States Company's stock, with a capital of a million, is selling at 160 and above. The Edison Company's 4,800 shares are held at $1,000 each, or tenfold their par value. It need not be said that the profit to stockholders in this, as in similar enterprises, is made by those who come in at the start.

The trustees of the Mutual Electric Company are William S. Clark, of Clark & Bothwell, No. 2 Nassau street, President; Hon. John P. Jones, United States Senate; A. M. Loryea, First Vice-President; P. P. Robinson, 65 Broadway; Hon. O. H. LaGrange, ex-Superintendent United States mint, San Francisco; Henry Mathey, metallurgist, 104 Washington street; Robert P. Noah, Assistant Corporation Attorney; Hon. George E. Spence, late United States Senator; Bernard Lande, 71 Broadway; A. B. Chisholm, editor *Mining Record*, Second Vice-President, and Charles E. Long, electrician, 37 Wall street.

The net earnings of the Tennessee Coal and Iron Co. for the month of October were $22,300

Chronicle 1751
London Dec 15/81

ELECTRIC LIGHTING.

At a crowded meeting of the members of the Society of Arts held last night at their premises at John-street, Adelphi, Mr. W. H. Preece, F.R.S., read a paper entitled "Electric Lighting at the Paris Exhibition." Sir Frederick J. Bramwell, F.R.S., chairman of the Council, presided. The room was illuminated by the Edison's incandescent lamps.

Mr. PREECE said that the recent International Exhibition of Electricity in Paris, marked an epoch in the history of the practical applications of that science to arts, manufactures, and commerce. He proposed on that occasion to refer only to its application to artificial illumination. It was as an exhibition of electric lighting that it was principally attractive, and those who saw it for the first time would never forget the vivid impression that the great blaze of splendour produced upon their minds on entering the building. There never could be anything like it again, for as wisdom grew with experience, no managers of future exhibitions were likely to repeat that terrific *mélange* of lights that flooded the interior of the Palais de l'Industrie with great brilliancy, but with an impracticable and impossible means of comparing and judging the relative merits of systems. For instance, at the forthcoming exhibition at the Crystal Palace, the building—splendidly adapted for the purpose—would be divided into sections, each section being lit by one, and only one system. He only purposed to select what appeared to him to be novelties and what seemed worthy of bringing to their notice as steps in advance. On the night of Aug. 29 there were in operation 277 arc lamps, 116 candles, 44 arc incandescent lamps, 1,500 incandescent lamps, or a total of 1,837 electric light in all, at the Paris Exhibition. Towards the end of the period during which the show was opened this number was very largely increased, and he had little doubt that the number reached 2,500 in the beginning of November. The exhibition of engines and machinery was very extensive, although English manufacturers failed to do what they might have done had they thought as highly of the exhibition at first as they did afterwards. The only extensive display was by Messrs. Robey, of Lincoln, to whom they were indebted for the engine which was used that evening. The display of lamps was the display of the building. There were very few novelties among arc lamps. The lampe soleil, which holds an intermediate position between arc and incandescent lamps, made a very effective display in the picture-gallery, where there were 20 lamps in 10 lanterns. It is to be seen in London lighting up the panorama in Westminster, and is a fixed, steady, durable lamp, giving a soft yellowish light. No one could deny that the Jablochkoff candle had done good service in the cause of electric lighting; but he was afraid that the exhibition in Paris had sounded the knell of all forms of candle, as well as those of the Werderman type. The rising favourite is the incandescent lamp, pure and simple. The display made by Mr. Swan in the buffet of the exhibition in the Congress Hall, and in the Pavilion at the Post-office, was brilliant and effective. The light was soft, uniform, and yellow. The incandescent light is totally free from those bright rays that are so injurious to the eyes, so uncomplimentary to the complexion, and so irritating to the worker, if they are accompanied with the least unsteadiness. It is so readily under control; it requires no skilled labour to replace it or attend to it; it can be fixed anywhere; it can be worked into the fixtures and decorations of a room, and it does not damage them, as gas and oil do. Incandescent lamps can be worked by either continuous or alternate current machines. In fact, the chief lesson of the Paris Exhibition was this, that the arc light is suited only for external illumination, and that incandescent lamps are eminently adapted for internal and for domestic illumination. The lesson had been carried into practice at the Savoy Theatre, where nothing could be more effective or more efficient than the illumination of the auditorium. One could breathe pure air, feel cool, and sit out a play without incurring a headache. There were several incandescent lamps shown at Paris besides those of Mr. Swan, notably those of Maxim and Lane-Fox; but that which possessed the greatest novelty, and was decidedly the most efficient, was that of Mr. Edison. The distinctive character of the Edison lamp is the remarkable uniformity of its texture and light-giving power. Many devices were shown for measuring the quantity of electricity consumed in any place by electric lamps; but that adopted by Mr. Edison, was sufficiently simple and accurate for all practical purposes. The proper distribution of light was a problem that remained to be solved, and curiously enough nothing whatever was done in Paris to improve the illumination of streets. Street illumination in England by electricity up to the present time was, as a rule, a questionable success. It was true that those parts lighted by electricity were better than places where gas was used, but the lighting by electricity was not one-tenth what it should be if the lamps were properly distributed. What was required was that lamps suspended in the centre of the road, so that the light should be properly and uniformly distributed. The question remained for discussion, Has the electric light been brought within the region of practical domestics? He had no hesitation in saying that it had; but whether it could be brought into economical contrast with gas, experience alone would show. Several houses were already illuminated by its agency. Others are in hand, and on a future occasion he hoped to be able, from the experiences of his own household to answer the question which everyone was asking, "How much is it to cost to light one's house with electricity?" There was no use blinking their eyes to the fact that electricity could be a dangerous servant in the hands of the careless and ignorant; in the hands of the skilled it had less danger than gas, or even oil. In Paris there were no less than five incipient fires, from the wires coming in contact with each other in the Exhibition building. The instances in New York were so numerous that the Board of Fire Underwriters had issued a series of instructions, but an additional security was obtained by Mr. Edison, by inserting in every branch wire a "safety catch," which is a short piece of lead wire that instantly melts if the strength of the current exceeds a certain value, and thus ruptures the circuit, stopping the flow of electricity, and producing safety. The completeness of Mr. Edison's exhibit was certainly the most noteworthy object in the exhibition. Many unkind things had been said of Mr. Edison and his promises; perhaps no one had been severer in this direction than he (Mr. Preece) had. It was some gratification for him, therefore, to be able to announce his belief that Mr. Edison had at last solved the problem that he set himself to solve. It might be taken as a rule that any system dependent on the exercise of abnormal energy is certain sooner or later to break down. All of the hated personal supervision, and personal supervision at home, was a species of abnormal energy. This was the great secret of the success of gas. It was the cause of the slow progress of the arc light; but it was because the incandescent light promised to rival gas in this respect that such a future was open to it. He had no doubt that the Crystal Palace Exhibition would be as interesting as that at Paris, and at the former they would see some of those beautiful courts—the Alhambra for instance—lit up and shown in a way seldom, if ever, seen before. (Cheers.)

Mr. EDWARD H. JOHNSON, the representative of Mr. Edison, said that Mr. Edison contemplated the manufacture of electricity on a large scale at a common central station, and the distribution of that electricity throughout every portion of the area of a city, to be used by the uneducated and unscientific public, without the supervision of experts in the employ of the company. They proposed to put such lamps as might be seen in that room in their houses, with such provisions as to render their supervision entirely unnecessary, and which might be placed under the care of ordinary house servants, and in their hands, no matter how ignorant they might be, no damage or waste was possible. This electricity converted into light might also be converted into power by the electric motor, and they might use electricity for any purpose for which electricity had hitherto been used. Mr. Johnson then showed the rapidity with which the light could be reduced or extinguished and renewed and increased, and a portable lamp was handed round the room.

Sir H. TYLER, M.P., Mr. CROMPTON, and others thought that more prominence should have been given to other systems.

The CHAIRMAN said that they had before them an excellent example of incandescent light, and if it could be introduced into houses at the same cost as gas he was sure they would willingly use it. If they could have electricity laid on to houses there was no doubt that the problem would be, to a great extent, solved.

Mr. PREECE, in replying to a vote of thanks, said it would have been waste of time for him to have given a description of lamps and processes that had been brought before the society more than once.

The meeting then separated.

THE EDISON [illegible]

Daily News 15/12/81

1752 A paper was read last evening at the Society of Arts, by Mr. W. H. Preece, F.R.S., upon Electric Lighting at the Paris Electrical Exhibition. Considerable prominence was given to the Edison incandescent light, and Mr. E. H. Johnson, Mr. Edison's representative in England, seized the opportunity to give an illustration of the new illuminant as applied to the lighting of private houses. The hall of the Society upon the arrival of the visitors presented a brilliant appearance. A number of tiny lamps shed their calm, clear light from aloft, where they hung suspended upon slim transecting wires, while in one corner burned a chandelier of three lights, and several portable lamps were in use upon the platform. The lights were of the famous horse-shoe pattern, and enclosed in small balloon-shaped glass globes. The horse-shoe, which is in a vacuum, is simply formed of a thin strip of carbonised bamboo wood, no thicker than a piece of ordinary sewing thread. The electricity which causes the horse-shoe to glow and shed light is turned on and off instantaneously by means of a switch with as little trouble as in the case of an ordinary gas jet. Mr. Preece, who was introduced in complimentary terms by the chairman, Sir F. J. Bramwell, traced the progress of the application of electricity to purposes of illumination from the early machines made by Professor Elias, of Haarlem, in 1842, and by Signor Pacinotti in 1861. The arc lamps, which were described in detail, and the Lampe Soleil, which hold an intermediate position between the arc and incandescent lights, had done good service. The rising favourite, however, was the incandescent light pure and simple. The chief lesson of the Paris Exhibition was that the arc light was suited only for external illumination, while the incandescent lamps were eminently adapted for internal and for domestic illumination. This had been properly recognised at the Savoy Theatre. Some slight consolation to persons interested in gas speculations was afforded by the lecturer when he stated that gas engines would be most suitable for generating the necessary power for producing the new light. Referring to devices for measuring the quantity of electricity consumed, he showed Mr. Edison's apparatus, an iron box like a small gas-meter. Inside is a glass cell containing two copper plates which have been immersed in a solution of sulphate of copper. A definite proportion of the current passing through a house passes also through this cell, depositing itself upon one plate, and the weight of copper so deposited measures the current used. Many unkind things had been said, said the lecturer, about Mr. Edison and his promises, and perhaps no one had been severer in this respect than himself. It was therefore some gratification for him to be able to announce his belief that Mr. Edison had at last solved the problem that he had set himself to solve. Specimens of the materials used in the manufacture of the lamps were shown, and the lights, which were generated by an engine on the Thames Embankment, were turned on and off several times, and reduced or increased in brilliancy instantaneously. Mr. Johnson explained that Mr. Edison contemplated the manufacture of electricity on a large scale for distribution over a wide area. It could be used without any skilled supervision, and could be applied to any purpose for which power was required, such as working sewing machines, &c. The cost of the lamps was so slight that his company intended to supply them without any charge beyond that made for the electric current. A discussion afterwards took place. Sir F. J. Bramwell, in bringing this to a close, spoke of the superiority of the new light over gas both as to its quality and manageability. He believed that we were near a practical possibility of applying it to the illumination of ordinary households. A vote of thanks to Mr. Preece was carried unanimously.

1754

1753 FATAL ELECTRIC LIGHT ACCIDENT.—A fatal accident has occurred at Hatfield House, the residence of the Marquis of Salisbury, to a labourer named William Dimmock, 22 years of age, in consequence of coming in contact with the wires conveying the electric current for lighting the mansion. It appears that Hatfield House is lighted with 117 lights on the Brush system, worked by an engine of 16-horse power, placed in the saw mills some distance from the house. Two electric wires and a telephone wire connect the saw mills with the mansion. For some distance they are carried on poles, but to save the unsightly appearance of the poles near the house, the wires are run along the garden wall, three feet from the ground, and for some distance they are not insulated or protected. The deceased was at work in the garden, assisting to lay a telephone wire, and was sent to ease the wire at the corner of the brickwork, to prevent it getting cut. While he was absent the lineman heard the wires shake, and on looking round saw the deceased lying on his back, and on going up to him he found he was dead. The machine was at work at the time, some of the Brush men being down from London repairing it, and it is supposed that the deceased slipped, and caught hold of the electric wires to save himself, and was immediately killed by the current. At the inquest the medical evidence showed that death arose from shock to the system, causing paralysis of the heart, and the jury returned a verdict that the deceased died through touching the electric wire, and appended a recommendation that there should be a stated time for working the current, and that notice should be given of it to all persons working near the wires. It was stated that to avoid similar accidents in future the wires would all be conveyed either underground or on poles out of reach. Daily News 15/12/81

1755

A Road to Test Electric Motors.

ST. PAUL, Nov. 18.—The *Pioneer Press* says that it has trustworthy [illegible] that President Villard of the Northern [illegible] Railway has recently entered into a contract with Mr. [illegible], "the Wizard of Menlo Park," for the construction [illegible] fifty miles of railway in Minnesota during the coming year, on which Mr. Edison is to test the efficiency of his electric engine as a motive power for railroads. It is agreed to pay Mr. Edison [illegible] for the entire road if the new power works [illegible], but if the [illegible] not prove satisfactory [illegible] the cost of the experiment will be borne by Mr. Edison and those associated with him. It is expected that the experimental line will be built between St. Cloud, Minneapolis and St. Paul.

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THE PARIS ELECTRICAL EXHIBITION.

No. XV.

The great and increasing interest taken in all that concerns the electric light, and the facilities offered by the Paris Exhibition, induced us to supplement our ordinary descriptive report of the exhibits by a special report on the electric light. Professors Ayrton and Perry having designed special instruments for making measurements with these intense lights, and having given great attention to the subject, were requested to prepare this special report. It will be found below. It is by no means exhaustive, nor is it intended to be. It deals for the first time with questions that have hitherto been carefully avoided, but which are of great importance. The general public necessarily look mainly to the question of total cost. How much candle-power do we obtain for a given lump sum? The answer to this question might easily be given, but, as a rule, a simple reply at present would be inconvenient. The electric light engineer's position is altogether different. He wants by experiments and experience to find out the weak places in a new system, and to remedy its defects. Hitherto very elaborate experiments have been made and published in most cases only as regards the steam motor and the dynamo machine; but now Professors Ayrton and Perry give us figures relating to the lamps as lamps. It will, no doubt, be carefully noticed that the authors seem to look upon some of their measurements as tentative, and hence not to be taken as expressing the absolute value of a lamp. They say, "when measuring the strength of the lights at Paris we were not able to extend our experiments on each lamp over a sufficient length of time to obtain an average result independent of fluctuations of the light, due to the adjustment of the lamps not being the best for the particular strength of current passing through it." Whilst then we look upon the figures in Table II., where only one series is given, as altogether preliminary, we think it cannot for a moment be disputed that the figures in the remaining tables, however they may be considered, do forcibly and conclusively show—

(1) That the ordinary ideas on photometry need to be carefully reconsidered. If these measurements show anything, they show the simple photometric apparatus of Rumford, &c., to give inconsistent results. We can quite understand the results obtained by one method not agreeing with those obtained by a second method; but the results of each method ought to be consistent. The whole question of photometry is one of great difficulty, and of great importance, and the Paris Congress would have been far better employed if its members had spent their whole time in discussing this matter, and agreeing upon a simple practical system, than in changing the name of the Weber to the Ampère, and debating about still more abstract questions.

(2) That the economy of any incandescent system increases with the temperature to which the filament is raised is conclusively shown, the figures relating to the Maxim lamp being very exhaustive, which is the more satisfactory as hitherto little has been known concerning this lamp.

THE EFFICIENCY OF ELECTRIC LAMPS.

By Professors Ayrton and Perry.

In accordance with your request, we send you a report on the efficiency of a few of the more important systems of electric lighting exhibited in the Paris Exhibition. Any system of electric lighting must consist of three parts—the engine producing the mechanical power, the electric machine for converting the power into electric energy, and thirdly, the lamp for converting the electric energy into light. Until the commencement of last winter the distinct purposes of these three machines were rarely separated one from the other in any experiments made on electric lighting. As a rule, the horse-power developed by the engine was simply measured from an indicator diagram, and the light given out by some sort of photometer; but when a small number of candles per horse-power was obtained it was very difficult to say whether this was due to friction in the engine or shafting connecting the engine with the dynamo-machine, or due to imperfections in the dynamo-machine itself, or, lastly, to the fault of the special system of lamp employed for converting the electric power into light. It therefore appeared to us desirable in all experiments on the economy of electric lighting to distinguish between the performance of the three distinct parts of the apparatus employed in producing the light.

To measure the efficiency of the dynamo-machine as distinguished from that of the engine, it is necessary by means of a transmission dynamometer to ascertain the amount of power given by the engine to the dynamo-machine, and, in addition, the current produced by the dynamo-machine through known resistances. Such experiments have been made by Mr. Schwendler, Dr. Hopkinson, and others, and the results will be found in the published accounts of their investigations.

But a complete measurement of the efficiency of an electric lamp can be made without any reference whatever to the amount of work given by the engine to the dynamo, or to the goodness or badness of either of the latter, exactly as experiments can be made on the efficiency of a gas burner without considering whether the company's mode of making the gas is good; or on the efficiency of a turbine attached to the water pipes of a house, without any inquiry as to whether the pumps employed by the company at their works are good or bad. To measure the efficiency of a turbine it would of course be only necessary to ascertain the quantity of water used or passed through it in any time, together with the loss of head and the amount of mechanical work given out by the turbine during the same time. So in the same way the efficiency of any instrument for converting electric energy into any other form of energy can be ascertained. For example, if we desire to measure the efficiency of an electro-motor, or machine for converting electric energy into mechanical work, we have to measure the current in Ampères* passing through it, and the electro-motive force in Volts maintained between its two terminals. The products of these two multiplied by 0·00134 gives the horse-power expended in the machine. Part of this will be wasted in heating the wires in the motor, part in overcoming mechanical friction, and the remainder, which may be measured by a force dynamometer, can be employed in doing useful work.

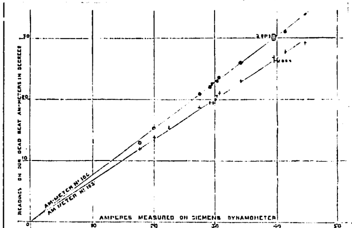
Such experiments—which, it must be remembered, are wholly independent of the goodness or badness of the mode of generating the electric current, or of the amount of heat produced in the wires connecting the electro-motor with the generator—have been made by our students during the last twelve months on a magneto-electric Gramme machine, running at different speeds, with various loads.

In the same way, if it be desired to measure the efficiency of an electric lamp, it is merely necessary to measure the current in Ampères passing through it, and the difference of potentials in Volts between the terminals of the lamp. The product of these two, as before, multiplied by 0·00134, gives the horse-power actually expended in the lamp, quite independently of the horse-power actually employed in generating the current. With the horse-power expended in the lamp must be compared the simultaneous illuminating power of the lamp in standard candles, and thus we arrive at the number of candles per horse-power expended in the lamp itself.

Such experiments, also, our students have been engaged at during the last twelve months with a Duboscq-Foucault and with a Serrin lamp, with different strengths of current, and with different fixed distances between the carbons; as well as, during the spring of this year, with incandescent lamps; and a sample of the results is given in Table I.

In making such experiments it is of great importance to be able to measure both current and electro-motive force rapidly with accuracy, so that all sudden changes may be recorded. For this purpose we have devised a dead-beat galvanometer, which measures the strength of the current directly in Ampères, but which can be calibrated by the use of a single Daniell's cell. This instrument—which we have called an Ampère-meter, or, for simplicity, an "Ammeter"—will be found described in the "Journal of the Society of Telegraph Engineers," No. 36, vol. x., 1881.

The proportionality of the deflections of our Am-meter with current may be easily tested, without the necessity of using strong currents, by turning the commutator to series, since of course the relative values of the deflections must be the same for the instrument in series as in parallel circuit. As a check to this, however, we thought it well at Paris to place three of our Am-meters in circuit with a



There was a lamp on the circuit, and the current was therefore varying somewhat. One observer of Siemens Dynamometer. One observer of three of our Am-meters. Only two of the Am-meters are given, because these two were the instruments used in all our Paris measurements.

Siemens dynamometer on an electric light circuit, and the curves above, or rather straight lines, show the results obtained with Nos. 103 and 104 used by us in our Paris measurements, the actual numbers being given in the table in the next column. Horizontal distances represent Ampères as measured on Siemens' dynamometer, and vertical distances the deflections in degrees on our two Am-meters respectively. The points corresponding with the third Am-meter are also in a straight line, but are not shown in the figure, as the instrument was not used by us in the experiments at Paris. It will thus be seen that not only can measurements be made of varying currents easily with our instrument on account of its dead-beat character, but that the deflections in degrees, at any rate for currents up to 50 Ampères, the strongest measured by us at Paris, are directly proportional to the current.

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We were not in a position to get any current we pleased, as our circuit contained electric lamps and a dynamo-machine. The less intense currents in the table were rather fluctuating, and as the Siemens dynamometer is not meant to measure varying currents, the consistency of the numbers is even more than could have been expected.

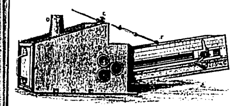
We have also constructed a dead-beat "Voltmeter," which, although it measures even large electromotive forces, can also be calibrated by the employment of a single Daniell's cell. A third instrument, an "Electric Power-meter," we have also designed to measure directly the product of the current into the electro-motive force—that is, the horse-power—and which can be used in place

* "Ampère" is the new name given by the International Electrical Congress to the practical unit of current, formerly called in England by proper consent a "Weber." The change was made, or rather the popular name was not authoritatively adopted, because Professor Helmholtz pointed out that in Germany the word Weber was used for a unit of current only one-tenth of the practical English unit.

of the other two instruments when only the horse-power expended in an electric circuit is required. This instrument—which, like the two previous ones, differs from all other instruments previously designed, in that the calibration can be effected with much smaller powers than it is required to measure—will be found shortly described in a lecture delivered on the 24th March of this year, at the Society of Arts, as well as a dispersion photometer, arranged by us to measure even strong electric lights in a small space, and which has been employed by us, conjointly with other photometers, in the experiments contained in this report.

Comparison of two Am-meters made at the Office of Messrs. Rowatt and Fyfe at the Paris Exhibition.

Am-meter No. 103. Deflection in degrees.	Am-meter No. 104. Deflection in degrees.	Siemens' dynamometer Ampères.
27·4	31	41·18
29·4	34	44·83
26·9	30·1	39·68
26·4	30·2	39·68
21·0	23·6	30·73
19·4	22	29·20
26·4	30	39·7
20·4	24	—
19·1	22·6	29·57
20·4	23	30·93
18·4	21	27·5
11·6	12·4	17·74
13·4	15	20
14·9	—	22·43
22·7	25·8	34·07



DISPERSION PHOTOMETER.

The special form of our dispersion photometer, which we employed at Paris, is shown in the accompanying engraving. It consists of a wooden box, A B, to which is joined a wooden tube B C, the joint being covered over with soft black cloth, to prevent extraneous light entering the photometer; A B contains the standard candle, for which D is the chimney. This candle illuminates a screen of tracing paper, while an exactly similar screen, cut from the same sheet of paper, is illuminated by a beam of the electric light passing down the wooden tube B C, and dispersed in passing through the thin double concave lens at H. The two pieces of tracing paper are, by means of mirrors, placed at exactly the same angle, reflected so as each to cover half the opening B, care being taken to avoid parallax by placing the head so that the intersection of the two mirrors is exactly in the centre of the opening. The wooden tube, B C, can, by means of the jointed rod E F, be placed at any angle with the horizon, so as to receive a beam from the electric light at any specified angle.

When using the instrument the tube B C is pointed at the electric light, so that the axis of the tube appears to pass through the arc itself. The concave dispersing lens is now moved parallel to itself along the tube by turning the handle H, until the illumination of the two screens is equal, the hole at B being closed by either the red or the green glass respectively. The intensity of the light in candles is then read off directly from the position on the scale of the pointer moving with H. It will be observed that there are three such scales passed over by the same pointer, the bottom one is used when the light is comparatively weak, and when it is 1½ft. from the end of the photometer, the middle scale when the light is stronger and requires that the end of the photometer shall be 3ft. away from it, and lastly, the top scale for the strongest lights when the end of the photometer and the light are placed at 5ft. distance. The numbers on each scale overlap one another—that is, a light which is so strong or so weak as to require the pointer to be put near one or other ends of one of the scales can be also measured on one of the other scales. The handle H gives motion to the lens by causing a pinion to run along a rack, a plate, shown in the figure, running between two guide rods preventing any turning of the lens and the slot in which the pin attached to the lens frame runs being closed by two india-rubber tubes, so that no extraneous light can enter. The above, it will be seen, is the application of our dispersive principle to the Bourguer's photometer. We originally adopted the Bourguer plan of two screens, one illuminated by the candle, and the other by the electric light, because this apparently furnished the only simple means of arranging a photometer by which a beam of light at any angle could be measured. We have since, however, adapted our lens dispersing principle to the Rumford's shadow method, and by a special arrangement of one mirror turning on an axis inclined to its plane, we are enabled to measure light coming at any angle from the lamp without introducing the error that would arise from variations in reflecting power if the light were reflected from the mirror at different angles.

This form of our dispersion photometer which we are using now we find extremely convenient, as the motion of the lens supplies a coarse adjustment, and that of the candle a fine adjustment, and the whole instrument can be employed quite close to even very strong electric lights.

As in the following experiments, it was desirable to know not merely the horse-power expended in the lamp, but also the current and electro-motive force, we employed two separate instruments rather than our Electric Power Meter. Not having one of our own Voltmeters for our measurements—the demand for these instruments being greater than the supply—M. Deprez was kind enough to lend us a dead beat galvanometer of 110 ohms resistance, and as this did not offer enough resistance to act alone as a shunt to an electric lamp, an additional resistance, varied in different experiments, was added. Actually, therefore, we employed one of our Am-meters to measure the current passing through the light, M. Deprez's galvanometer with a resistance box to measure the electro-motive force, and one of our dispersion photometers to simultaneously measure the intensity of the light.

When making a measurement the main circuit was momentarily interrupted by disconnecting one of the leading wires from the electric lamp to be tested and placing our Am-meter, to which two thick wires were attached, directly in circuit. The terminal of the Am-meter which was connected with the lamp was permanently in connection with one terminal of the high resistance galvanometer, the other terminal of the latter being permanently connected with one end of a resistance box. A comparatively thin wire attached to the other end of the resistance box

was connected with the other binding screw of the lamp, so that the galvanometer and resistance acted as a shunt to the lamp, and thus the current passing through it measured the difference of potentials between the terminals of the lamp.

It will be observed from our table that we always give two measures of the strength of the electric light, as compared with that of a standard candle. One of these is the measurement when the two lights compared are seen through green glass, and the other when they are seen through red glass. It seems to us a very difficult matter to say what is the meaning of the strength of a light in terms of another light which is of a totally different colour, and although there is no doubt that the electric light and a candle are quite different in colour, the intensity of one is constantly expressed in terms of the other without reference to colour. If then, while awaiting the adoption of a better standard than a candle, the intensity of the electric light is to be measured in terms of that of a standard candle, it has seemed to us that the only method of comparison that can be employed without elaborate spectroscopic observations is that of comparing the amounts of two very different kinds of monochromatic light in each.

The measurements given in Table No. II. occupied five evenings, not on account of any delay in carriage of our measuring apparatus from place to place in the Exhibition, since the three instruments employed could easily be carried by ourselves; but because so much time was necessary to persuade the owners of the various systems of electric lighting into giving us permission to make the measurements, even although, in order to economise time, we tried to obtain such permission during the day.

There are some other observations which showed a certain amount of inconsistency with one another and with the results given in this table, and which are not here given, as they will be referred to further on. A column might have been added giving the value of the ratio of the electro-motive force to the current, and which would represent the resistance of the arc were there no opposing electro-motive force; but as there is no simple means of measuring how much of the opposition in a light to the current is due to resistance and how much to an opposing electro-motive force, we did not wish it to be inferred from our giving such a table that we regarded it as all due to the resistance.

Of course, it must be carefully remembered that the last column headed "Candles per horse-power" means per horse-power actually expended in the lamp. It is much more usual to state candles per horse-power expended in the engine, and as the efficiency of the best generators is about 80 per cent., and as in the case of a dynamo some portion of the work—which in an ordinary Gramme and Siemens machine is about one-half—is wasted in heating the coils of the machine itself, it may usually be assumed that upwards of 2½-horse power is expended in the engine for every horse-power actually expended in the lamps themselves.

We do not consider that the last column, "Mean candles per horse-power," has any physical meaning, and we have merely added it because people have not yet acquired the habit of separating the two mono-chromatic measurements from one another. To persons who have not used our photometer, it may be necessary to say that our measurements will as a rule be found greater than those given by Rumford's method, or by any simple distance method of measuring. At first sight this seems to point to a defect in our photometer, and we regarded it in this light for some time, but after a very exhaustive examination of the possible sources of error in the use of our instrument, we have come to the conclusion that it is not our measurements that are wrong, but that Rumford's and other direct methods which are usually supposed to be perfect, may really give incorrect results.

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An examination of Table 3, which gives the results of experiments made by both methods on a Foucault-Duboscq lamp worked by Grove's cells, will show that when the light examined is weak there is no great difference in the answers given by the two methods. This is further shown by the first results of Table 4, but in the remainder of the table it will be found that our photometer gives sometimes more than 1½ times the answer which the direct method gives, and as a rule more discrepancy than this is observed with stronger lights. We have found that with strong lights sometimes we obtain the most varying results by the direct method, and at other times we get most consistent results. We are still investigating this matter, and although we are not yet prepared to state completely all the causes of the different results given by the two methods, we have proof that our method gives a nearer approximation to the light actually given out by the lamp; and this greater accuracy of our method arises from our measuring it at a place which is nearer to the lamp without

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TABLE I.

Nature of lamp.	No. of cells.	Method of measuring light.	Strength of light. Red.	Strength of light. Green	Ampères.	Volts.	Horse-power.	Candles per horse-power. Red.	Candles per horse-power. Green.	Date.
Swan	20	Bouguer's	8·5	—	1·22	31·1	·052	162	—	May, 1881.
"	25	Bouguer's	23·6	—	1·57	41·1	·087	276	—	
"	30	Bouguer's	39·1	—	1·78	47·5	·119	338	—	
"	20	Rumford's.........	3·1	—	1·17	31	·06	51	—	October, 1881.
"	25	Rumford's.........	12·7	15·4	1·75	37	·087	146	177	
"	30	Rumford's.........	30·8	41·5	2·10	42·5	·12	257	346	
"	40	Rumford's.........	132	—	2·8	58·8	·22	544	—	
Maxim............	20	Rumford's.........	0·25	—	1·2	31·5	·05	5	—	
"	25	Rumford's.........	2·6	—	1·5	38	·07	35	—	
"	30	Rumford's.........	6·8	—	1·8	46·7	·11	62	—	
"	40	Rumford's.........	26·3	31	2·3	61·2	·19	138	163	
"	48	Rumford's.........	87	105	2·8	67	·25	348	420	

TABLE III. *Foucault-Dubosq Lamp worked with Grove's Cells, City and Guilds of London Technical College, Finsbury, Oct.*, 1881.

Ayrton and Perry's Photometer. 55in. from lamp. Candle-power. Red.	Ayrton and Perry's. Green.	Rumford's method. D = 207in. d. in inches. Red.	d. in inches. Green.	Candle-power. Red.	Candle-power. Green.	Ratio of lens method to Rumford's method. Red.	Ratio. Green.	Mean red.	Mean green.	Ampères.	Volts.	Horse-power.	Candles for one-horse power. Red.	Candles for one-horse power. Green.	
121	—	18·3	—	127	—	0·9	—	125	—	9·4	30·5	·38	326	—	
—	207	—	15·6	—	176	—	1·1	—	192	9·4	30·5	·38	—	500	
121	—	17·6	—	136	—	0·9	—	128	—	9·4	28·1	·35	365	—	
—	201	—	15·1	—	184	—	1·1	—	194	9·2	29·8	·37	—	521	Observers change places.
108	—	19	—	116	—	0·9	—	112	—	9·2	28·1	·35	320	—	
—	210	—	14	—	216	—	1·0	—	213	9·8	28·1	·37	—	575	Observers change places.
158	—	15·9	—	169	—	0·9	—	163	—	9·8	46·8	·61	267	—	
—	334	—	12·7	—	262	—	1·3	—	298	12·6	33·6	·57	—	522	
190	—	16·25	—	161	—	1·2	—	175	—	7·7	52·1	·54	324	—	
—	256	—	13·2	—	243	—	1·0	—	249	12·6	32·9	·56	—	444	
132	—	17·25	—	144	—	0·9	—	138	—	12·6	32·9	·56	246	—	Observers change places.
166	—	15·7	—	171	—	1·0	—	168	—	12·6	32·4	·55	305	—	
—	196	—	13	—	252	—	0·8	—	224	12·6	31·2	·53	—	422	
					Means	0·95	1·05								

The direction of the light was nearly the same to the two photometers.

Table II. *Experiments on some Electric Lights in the Paris Exhibition. All lights measured horizontally.*

Name.	Electro-motive force in Volts between the two terminals of lamp.	Current in Ampères flowing through lamp.	Horse-power expended in the lamp.	Candle power. Green.	Candle power. Red.	Candles per H.-P. Green.	Candles per H.-P. Red.	Mean candles per horse-power.
Crompton ..	37·7	25	1·26	2016	1849	2314	1467	1890
Joel, Semi-incandescent	6·6	41·2	0·39	70	60	179	154	166
„	7·1	45·0	0·43	75	70	174	163	168
„	6·6	50·0	0·44	75	68	170	155	162
Pilsen	36·8	10·33	0·48	780	512	1625	1066	1345
Brush	38	10	0·51	2025	961	3970	1884	2127
Sautier — Lemonnier. One lamp on A Gramme Machine ...	40	43	2·3	15376	5625	6685	2446	4565
Ditto.	45	42	2·54	15376	9025	6054	3553	4803
Maxim Incandescent ...	53·6	3·32	0·24	135	120	562	500	531
Maikoff	45·3	8·3	0·50	397	307	794	614	704
Sautier Lemonnier. One of ten lamps on H Gramme machine ...	40	12·5	0·67	540	310	806	463	634
	„	„	„	*784	125	1170	187	678
Gravier	46·6	9·2	0·58	1023	349	1173	604	1189
Serrin	31·1	35·8	1·49	2148	938	1616	630	1123
Cance	51·8	16·7	1·16	3445	1156	2970	997	1983
Weston	33·7	21·7	0·98	2663	1024	2717	1045	1881
Maxim Incandescent ...	73	2·5	0·214	350	290	1431	1189	1311
	77	2·8	0·294	270	262	934	886	910
	77	2·8	0·294	350	350	1211	1211	1211
	81·3	2·8	0·305	422	350	1383	1148	1265
	85·3	3·3	0·377	512	360	1358	954	1156
Engine and dynamo machine running at higher and higher speeds ...	88	3·6	0·421	870		2050		
	105·5	4·6	0·650	1225		1883		
				†1370				

* This measurement of light was made on Rumford's Method.
† This lamp now broke.

Ayrton & Perry's Photometer, 59in. from lamp. Candle power. Red.	Green.	Rumford's Method. D = 219·5 values of d in ins. Red.	Green.	Rumford's Method. Candle-power. Red.	Green.	Ratio of lens method to Rumford's method. Red.	Green.
35	37	30·2	38·5	31	33	1·1	1·1
31	36	44·0	41·5	25	28	1·2	1·3
85	106	25·9	21·5	72	101	1·2	1·0
147	262	18·9	15·2	135	209	1·1	1·25
154	187	16·8	14·8	172	220	0·9	0·85
246	262	16·8	—	172	—	1·4	—
—	278	—	14·3	—	237	—	1·1
206	—	16·0	—	188	—	1·1	—
					Means	1·1	1·1
		D = 219·5					
114	147	21·5	21	80	109	1·4	1·3
126	203	21	22·5	84	95	1·5	2·1
220	330	17	15·25	167	207	1·3	1·6
233	339	18	14·5	149	229	1·6	1·5
456	647	10·5	9·75	437	507	1·0	1·3
351	539	12·5	10·5	308	437	1·1	1·2
317	422	15·5	13·5	201	264	1·6	1·6
305	377	16·25	13·0	182	285	1·7	1·5
					Means	1·4	1·5
228	207	17	14	107	216	1·4	1·2
438	589	15	11·5	214	364	2·0	1·6
438	589	15·25	12·5	207	308	2·1	1·9
713	790	12	9·5	334	544	2·1	1·5
589	713	13	11·0	285	363	2·1	1·9
598	646	11·5	11·0	230	363	2·6	1·8
					Means	2·05	1·65
		D = 225·5					
—	—	22·25	19·5	103	134	—	—
		D = 228					
130	136	25·37	23	81	98	1·6	1·4
228	380	17	14	180	266	1·3	1·4
380	692	14·5	13·5	247	285	1·5	2·5
547	692	10·5	11·5	471	393	1·1	1·7
—	973	—	9·5	—	576	—	1·7
					Means	1·4	1·7
1118	—	9	—	641	—	1·8	—

Table IV. *Experiments on the Maxim Incandescent Light, at the City and Guilds of London Technical College, Finsbury.*

Mean red.	Mean green.	Ampères.	Volts.	Horse-power	Candles per horse power. Red.	Candles per horse power. Green.	Mean candles per horse-power.	Remarks.	
								Lamp No. I. 26th October, 1881.	Student reading one of the photometers.
33	35	2·42	57	·185	178	189	183	Red measured before green. Observers change places.	
28	32	2·42	57	·185	151	173	162	Green before red. Observers change places.	
78	105	3·07	67·6	·28	279	375	327	Red before green. Observers change places.	
141	235	3·65	76	·37	381	635	508	Red before green. Lamp observed to be blackening, due to volatilization of carbon filament.	
163	203	3·7	76	·38	429	534	482	Red before green.	
209	—	4·13	89·1	·5	418	—	—	No green Rumford measurement taken.	
—	257	4·16	89·1	·5	—	514	—		
197	—	—	—	—	—	—	—	This lamp broke on putting on 50 cells.	
								Lamp No. II. 26th October, 1881.	Students reading both photometers.
97	128	3·01	67·2	·271	358	472	415		
105	149	3·01	67·2	·271	387	550	468		
194	258	3·54	78·9	·374	519	690	604		
191	281	3·54	78·9	·374	511	742	626		
446	577	3·98	86·7	·462	965	1249	1107	Lamp seriously clouding.	
329	488	3·98	„	„	712	1056	884		
259	343	3·98	„	„	561	742	651	„ „	
243	331	3·98	„	„	526	716	621	The lamp now broke.	
								Lamp No. III. 26th October, 1881.	Students reading both photometers.
197	271	3·68	77·7	·383	514	707	610		
326	476	4·10	86·4	·475	685	1002	843		
322	448	4·10	86·4	„	678	943	810		
523	667	4·49	95·0	·571	916	1168	1042	Lamp clouding.	
437	538	„	„	„	765	942	854		
414	504	„	„	„	725	883	804	„ „	
								Lamp No. III. 2nd November, 1881.	
—	—	3·84	86·7	·446	231	300	265	Lamp now broke.	
								Lamp No. IV. 2nd November.	Students reading both photometers.
106	117	2·94	68·4	·269	394	435	414	Red measurement made first.	
204	323	3·54	78·0	·374	545	864	704		
314	489	4·24	85·8	·488	643	1002	823		
509	543	4·38	96	·564	902	963	933		
—	775	4·8	108	·695	—	1115	—	Lamp now broke.	
								Lamp No. V. 2nd November.	
880	—*	5	101·4	·7	1257	—	—	Broke after first measurement.	

* In order to measure the efficiency of lamp No. V. for high electromotive forces before the clouding, arising from the evaporation of the carbon filament, had taken place, 90 Groves cells, producing a difference of potentials of 101·4 Volts at the two sides of the carbon filament, were at the commencement attached to this lamp. One measurement was taken when the lamp broke.

Table V.—*Foucault-Duboscq Lamp. Comparison of Ayrton and Perry's Photometer, with Rumford's Method of Measurement, 7th November, 1881.*

All through red glass.

Dispersion photometer, 81in. from lamp.	Rumford's method. Screen 225in. from lamp.		Rumford's method. Screen 609·5in. from lamp.	
Candle power.	Distance of candle.	Candle power.	Distance of candle.	Candle power.
1005a	6·9	1063c	25·7	562p
686a	7·6	876p	24·5	620c
756p	8·0	790a	23·75	658c
660p	8·25	743c	25·2	615a
643c	9·1	610p	24·6	615a
702c	10·0	506p		
Mean.		Mean		Mean
742		765		608

The letter affixed to each measurement is the initial of the observer, who usually went to another instrument as soon as he had made an observation, in order that personal errors might be eliminated. Each observer carried his red glass with him.

introducing the error which would necessarily arise in the measurement of the small distance of the candle if an attempt were made to experiment on a strong electric light with a Rumford's photometer put as near the lamp as we place our instrument.

As we have said, we are engaged in a complete investigation of this matter, and we content ourselves with here giving a few results obtained, in Table 5, on the 7th inst. in a room which seemed to have a perfectly clear atmosphere. In making these observations the three observers were continually being changed from one photometer to another, and the letters attached to each measurement denote the three observers. The numbers indicate what we have found to be a pretty general rule, namely, that Rumford's method of long distances gives a smaller result for the power of the light itself, sometimes much less than half the result obtained simultaneously in the same direction by the same method at shorter distances.

In an arc light the result may be partially caused by

Table VI.—*Simultaneous Measurements made on a Serrin Lamp worked by a Dynamo, 16th November, 1881.*

Ayrton and Perry's photometer, 150in. from lamp.		Rumford's method, screen 300in. from lamp.		Rumford's method, screen 600in. from lamp.		Electromotive force in Volts between the two terminals of lamp.	Current in Amperes flowing through the lamp.	Horse power expended in arc.
Red.	Green.	Red.	Green.	Red.	Green.			
857	1406	1712	2975	850	1600	34	32·2	1·467
947	1406	1216	3600	900	1406	34	29·4	1·339
576	---	1406	3600	946	1773	34	26·6	1·283
947	---	1498	—	997	---	34	26·6	1·283
1600	6400	1406	7625	779	2130	32	28	1·200
1277	2844	1406	7625	900	3600	32	30·8	1·321
900	1201	1406	3600	1052	2399	32	28	1·200
900	1655	900	1837	638	1283	32	29·4	1·261
1143	3115	1837	3600	1024	2608	32	29·4	1·261
2104	2075	1111	3600	997	3265	32	29·4	1·261
		Screen now put at 480in. from lamp.						
--	5993	2070	4384	1111	3600	31	30·8	1·279
1175	3425	1914	3836	1210	4208	31	29·4	1·221
1143	3115	1541	4096	1837	3989	30	29·4	1·182
1052	5993	1264	4384	857	4445	33	26·6	1·176
1363	—	769	---	1246	---	---	---	—
Means:								
1128	3294	1433	4212	1023	2810	..	---	—

1767

the fact that the intensity of the light in different directions, in the same vertical plane, is quite different, so that although care has been taken to place the near and distant photometers in the same horizontal plane with the arc, an error in placing the near photometer is more important than an error in the distant one, if the illuminated areas to be looked at are of the same size. This is the case when the Rumford or any ordinary distance method is employed, and evidently furnishes another reason why such a method must be inaccurate at short distances. But with the dispersion photometer this difficulty is not introduced, since the effect of the lens is to place under examination much the same small pencil of rays, however near it may be to the lamp. It will be observed that this difference, arising from the distance of the photometer, is as well marked in the long series of experiments that we have made with the Maxim incandescent light, and as it is not probable that there is any such great difference in the intensity in different directions with an incandescent lamp, it follows that some other cause must be sought. That the effect in question may be produced by dust particles of a very minute kind floating in the air we think highly probable, for our experiments show, first, that the greater the intensity of the light—that is, the greater the proportion of blue to red rays—the greater is this difference; secondly, that the difference is more marked when the experiment is made through green than through red glass, both results leading to the same conclusion, that it is the highly refrangible rays which strike the first screen, and which never reach the second screen at all, that cause the difference. But if this is the case, then it must be quite evident that in comparing the efficiencies of electric light—that is the number of candles per horse-power—the lights ought to be measured at short distances, such as the three or four feet we employ rather than the much longer distances necessary for accurate measurements by any of the ordinary direct methods. The ~~loss~~ which is caused by absorption or by reflection, from the minute dust particles in the air is undoubtedly a most important question, but is really a distinct inquiry, since it would obviously be most unfair that one electric light should be said to give fewer candles per horse-power than another, simply because in the many feet of air between the light and the distant Rumford's shadow photometer there happened to be greater dust absorption or reflection on the day the one experiment was made than on the day when the second was carried out.

When measuring the strength of the lights at Paris, we were not able to extend our experiments on each lamp over a sufficient length of time to obtain an average result independent of fluctuations of the light, due to the adjustment of the lamp not being the best for the particular strength of current passing through it. The observations given in Table VI. were made simultaneously with three photometers in the City and Guilds of London Technical Laboratory by competent observers, a Serrin lamp which had been carefully adjusted being employed, but the light from which, nevertheless, fluctuated somewhat, although the engine and dynamo machine were running fairly regularly. Only horizontal rays, as nearly as possible in the same azimuth, were received on the photometer screens, which in this and other similar experiments were each composed of a sheet of white blotting paper, and yet it will be observed that there is but a bad agreement in the results, even although no observations were taken unless the light seemed to be temporarily steady, and although each set of observations was made quite simultaneously on a signal being given. It it also to be observed that there are no such great variations in the horse-power expended in the arc as there are in the light, although both the Am-meter and Volt-meter being very dead beat recorded every change in current and electromotive force.

From this it is quite clear that if one photometer only had been employed, and if only some three or four observations had been taken, the conclusion that would have been arrived at regarding the efficiency of the light, or number of candles per horse-power, would have depended very much on the distance at which the photometer happened to be placed from the light, and on which of the many results contained in Table VI. happened to be those included in the experiment.

A careful distinction must be made between such fluctuation effect as is shown in Table VI. and the variations due to the rays of light to the photometers being in different azimuths. For example, Table VII. shows the results of simultaneous measurements made in the same horizontal plane as the arc, the lens of the dispersion photometer being placed 115½in. north from the lamp, one of Rumford's screens 121in. east from the lamp, and the other 343in. south. At the shorter distances the measurements by Rumford's method for the stronger lights are rather inaccurate, as the candle was sometimes less than 5in. from the screen, and therefore its exact distance could not be determined with great accuracy.

The lamp was a Foucault-Duboscq in good adjustment, and we used 100 Grove's cells so as to get a steady current. All measurements were made through red glass, and the observers changed places after each measurement, carrying their pieces of red glass with them.

Table VII.

	Ayrton and Perry's Photometer, 115½in. from Lamp North.	Rumford's Method. Screen 121in. from Lamp South.	Rumford's Method. Screen 343in. from Lamp East.
	—	849	384
	469	756	394
	371	563	566
	360	815	645
	629	622	371
	571	648	333
Means	480	708	419

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NEW YORK HERALD, FRIDAY, NOVEMBER 25, 1881.

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EDISON'S ISOLATED COMPANY.

The Edison Electric Light Company, which owns Edison's patents for North and South America, has just licensed a new company, called the Edison Company for Isolated Lighting, to use the Edison patents in all parts of the United States outside of present gas limits. A large business has already been successfully developed in lighting isolated factories and large buildings. The following places are now lighted by the Edison company:—The Pemberton Mills, Lawrence, Mass.; the Baldwin Locomotive Works, Philadelphia; the factories of Hinds, Ketcham & Co., and of Nathan & Dreyfus, New York city; the factory of Moore, Tingue & Co., Portchester; the Orange woollen mills and the Newburg woollen mills, United States Rolling Stock Company's works in Chicago and in Urbana, the Winona Mills in Winona, Minn. The new company, which has a capital of \$500,000, gives one-half of its stock fully paid to the Edison Electric Light Company for a license. The following officers in the new company were elected on Wednesday:—S. B. Eaton, president; Egisto P. Fabbri, treasurer; Calvin Goddard, secretary; M. F. Moore, general manager. Executive Committee—James H. Banker, E. P. Fabbri and S. B. Eaton. The directors of the new company are:—Messrs. Edison, Banker, Lowrey, Fabbri, Eaton, Flagler and Meadowcroft.

POLITICAL NOTES

1769

EDISON'S MAIN LAYING.

The Down-Town District Already Wired—Causes of Delay on the Work.

Col. Eaton, Vice-President of the Edison company, was asked yesterday about a report that the company had suspended work in the district down town which it has been preparing to light with electricity, and that nearly all the men employed in the machine shop of the company had been dismissed. Col. Eaton said that the work of wiring the down-town district in question had
been finished, that they had put wires in 11,000 houses,
and that 14,000 lamps are ready to be adjusted. All but
a small force of the men employed in wiring these build-
ings have been laid off, because there is nothing for them
to do. The machine shop in Goerck street belongs to Mr.
Edison personally. He has recently laid off a part of the
force there, because he has been manufacturing
dynamos faster than he could set them up. They are
now making at these shops twelve large dynamos for the
down-town district, one for London, and 400 small
dynamos for isolated lighting. For two weeks past these
shops have been worked night and day. The Electrical
Pipe Company is working more men than it ever em-
ployed before.

"The delay in lighting the down-town district," said
Col. Eaton, "is caused by our inability to get contracts
for material—especially copper and iron pipe—executed
on time. The delay is altogether in laying the mains.
Six miles have been laid. We have done no work since
the day before Christmas until to-day, because of the
recent rains. With an open winter we can finish laying
the mains and be ready to light the district by March."

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CONSEIL MUNICIPAL DE PARIS

Séance du 28 novembre 1881

La séance est ouverte à 5 heures 3/4, sous la présidence de M. Engelhard.

M. Cernesson présente un rapport concluant à ouvrir au préfet de la Seine un crédit de 75,000 francs pour faire des essais d'éclairage électrique dans les bâtiments de la préfecture de la Seine.

L'essai serait fait dans les locaux du conseil municipal, il ne serait pas limité à l'éclairage par incandescence. Voici les dispositions que la commission propose d'adopter :

1° Eclairage de la salle des séances au moyen de 80 lampes à incandescence Swan et de 6 becs Siemens à arc voltaïque munis de globes, placés dans la partie supérieure de la salle ;

2° Eclairage de la salle des commissions, où est installée la bibliothèque du conseil au moyen de 18 lampes à incandescence Martin.

3° Eclairage de la salle de la commission de voirie au moyen de 24 lampes à incandescence Lane-Fox.

4° Eclairage de la salle des commissions d'instruction publique par 20 lampes Swan.

5° Eclairage de la Salle des Pas-Perdus au moyen de 2 lampes Wedermann.

6° Deux becs Siemens dans le couloir formant entrée.

7° Quatre becs Brusch dans l'escalier.

En outre deux ascenseurs électriques seraient installés, un dans les locaux du conseil, un dans les appartements du préfet.

M. Hervé propose l'ajournement.

Cette proposition d'ajournement, appuyée par M. Marsoulan et combattue par M. le directeur des travaux et M. Voisin, est repoussée.

Les conclusions de la commission sont adoptées.

M. le Président communique au conseil les lettres par lesquelles MM. de Heredia, de Lanessan, Jules Roche, Henry Maret, et Tony Révillon, élus députés, donnent leur démission de membres du conseil municipal.

M. le Président. — Je crois exprimer les sentiments du conseil en disant que nous regrettons tous d'être privés du concours de collègues qui ont donné de nombreuses preuves de leurs aptitudes et de leur dévouement aux intérêts de la ville de Paris.

Nos sympathies accompagneront au Parlement les nouveaux députés de la Seine.

La prochaine séance est fixée à mercredi.

La séance est levée à 6 heures et demie.

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THE ELECTRICIAN, NOVEMBER 26, 1881.

KING KALAKUA AND EDISON.—Before leaving New York, King Kalakua called on Mr. Edison. He was accompanied on his visit by the Attorney-General of his island kingdom, Mr. Armstrong, and by an intimate friend residing in this city, whose acquaintance he made in Vienna. Punctually at nine o'clock in the evening his majesty alighted from the carriage of his friend in front of the Fifth-avenue mansion. He was introduced to Mr. Edison, who escorted him through the building, and by means of models, maps, drawings, and the 55 lamps in operation, explained the theory of the conversion of steam-power into electricity and the generation of light in the carbon loop. Escorting his distinguished visitor to the library, Mr. Edison first explained the science of the light, and then, by reference to maps of the district that his engineers are preparing for the experiment, the application of his system to the practical requirements of a city. The region to be lighted will require 22,000 lights, all of which are to be supplied from a central station in Pearl-street, where twelve engines of 185 horse-power are to be placed. Ten of these will be in constant operation, the other two being held in reserve to meet the emergencies of accident. The engines will be run at a rate of speed equal to that of a locomotive at sixty miles an hour, and a new feature of the system is that no belts are employed to transmit the power to the dynamo-electric generators, and the power is applied directly, avoiding the irregularity and vibration arising from the slipping of the belt which seems inseparable from the old practice. The mains consist of large iron pipes, in which the crescent-shaped positive and negative conductors are carried, being insulated from such by means of a non-conducting material with which the pipes are filled when in a pasty condition, induced by heat, but which hardens like a concrete pavement in the process of cooling. These mains in their passage through the streets are all connected with each other by means of ingenious connection boxes, the whole forming a subterranean network of electrical conductors comparable to the capillary circulation in the skin of an animal body. His Majesty listened with intense but almost silent interest, and examined the cross-sections of the electrical mains and the interior arrangement of the connection boxes with critical closeness, now and then asking a question in the purest English imaginable. He seemed particularly interested in the statement that after steam power had been transformed into electricity and carried to a great distance in that form it could again be converted into motive power by means of an electrical motor, and sold to customers for the purpose of running elevators or operating hoist-ways. His eyes lighted when he was told that one of the most profitable departments of the business of the company would be the sale of power to manufactories and business firms in quantities as small as a single-horse power, costing, under circumstances of ordinary use, not more than eight cents a day. From the library Mr. Edison led the way to the front parlour, brilliantly lighted. Pressing the toe of his shoe upon a knob projecting from the floor, every lamp was instantaneously extinguished and as suddenly blazed out again. The inventor next turned the stopcock of a single lamp among the group and extinguished it. The party then ascended to the upper floor, where more wonders were in store, and then descended two flights beneath the street level, where, in a low-ceiled vault, a small engine was operating with nearly absolute silence, a generator whose cylinder performed 1,200 revolutions per minute. After inspecting every detail, His Majesty took leave of the inventor, and repaired to his carriage. One of the points that appeared to impress him most was the steadiness of the light, and its freedom from vibration.—New York Times.

#1777

Passing from the Italian Section to that of America, we see in the Edison machine one of the latest developments of the germ introduced by Pacinotti. Edison has aimed at simplicity and economy, and a brief description of his machine will enable our readers to form some opinion as to how far he has succeeded. It is impossible to give absolute figures, but the agents of Mr. Edison both at Paris and in England have continually promised that facilities should be given to obtain measurements. Unfortunately, at Paris Mr. Edison's large machine was late in arriving, and later still in being put to work, so that these measurements have been deferred till an opportunity arises for investigation either at the Crystal Palace or some other place in England. We have already referred to the Edison lamps. We have called attention to the completeness of his system, but it remains for experience to test the economy of the system.

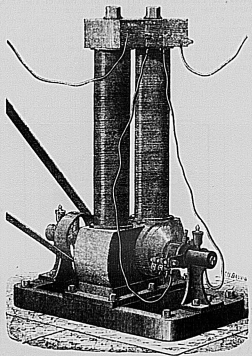
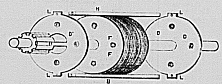


Fig. 5.

A general idea of Edison's machine will be obtained from Fig. 5, which illustrates one of his small machines. The principle, however, both of his small and his large machines is the same. We are glad to see that the opinion expressed by Professor Perry in his lecture to the Society of Arts regarding large machines is taking root, and that constructors are beginning to understand that large machines tend to greater economy. Mr. Edison's machine is not designed to suit the taste of æsthetic individuals, but every part is supposed to be designed for economy. We think the poles of the machine partake a little too much of the form of lamp posts, and we certainly should like to know the reasons why this particular form and size have been adopted. Professor Rowland has, we understand, mathematically investigated the proportions best suited for dynamo machines, and there is little doubt as to the accuracy of the investigations by such an accomplished and careful mathematician. The first peculiarities of the Edison machine that strike the observer are the long arms and the extraordinarily heavy pole pieces of the electro-magnet, but we think the greatest ingenuity has been shown in the construction of the armature. It is difficult to conceive of anything more simple, or that can be more cheaply constructed. As we have before mentioned, its economy we have not determined. The armature consists of several parts. The central part, forming the core of the armature, shown by F F, Fig. 6, is made of thin, soft, iron discs, insulated from each and from the shaft. The discs are perforated, as shown, in order to allow of bolts being passed through, by which means the whole series of plates are securely held together. The bolts, of course, are insulated from the plates or discs. At the end of the core, away from the armature, are a number of copper plates, D D, perforated as shown to slip on the axle, and to be fastened and fitted with the lugs L L, to which copper bars can be attached. Somewhat similar copper discs are used at the armature end, but the central perforation of the disc is much larger, as will be seen in D[1], and a portion is left to form a tongue, C. This tongue is used to form the contact pieces in the commutator. The commutator H is formed of insulating material grooved on its surface with grooves equal in width and depth to the tongues left on the copper plates. The tongue, bent outwards, slides into the groove of the commutator, each tongue having its proper groove. The copper plates at the commutator end are joined to the plates at the other end by copper bars, B B (Fig. 7). It will be seen that these copper bars, with the connecting plates or discs, correspond to the wire coils of the ordinary armature. The bars B B are insulated from the core F F, by leaving a little air space between. Of course, unless the armature is carefully protected from dust and metallic particles, or any other conducting material, contact might often be made between the bars and the core. The armature, however, is carefully protected. It will thus be seen that this armature is built up of the simplest forms—the discs, insulating pieces, bars, &c., can all be stamped or cut by machinery, involving little expense compared with that of winding. If any mishap occurs to any part of the machine the repairs are soon done, and the time lost is very short. The armature is connected to a wooden tube carried by the axle. The resistance of such an armature is exceedingly small, and Mr. Edison claims to have arrived practically at a similar solution of the problem of the relation of internal resistance of dynamo machines to external resistance as that Sir W. Thomson demonstrated mathematically at the last meeting of the British Association.

Fig. 6.



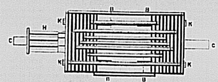


Fig. 7.

THE EVENING POST: NEW YORK, DECEMBER 1, 1881

#1778

THE ELECTRIC LIGHT.

Its General Introduction Down Town Postponed until Spring—The Troubles of the Edison Company—Unfulfilled Contracts.

The electric-light companies of this city are all more or less embarrassed by the difficulty of obtaining machinery and material for their mains and wires. The Edison Company especially has been delayed by the want of boilers and the need of large quantities of iron pipe for their street mains, of which nearly five miles have been laid in the down-town district since summer. About one-third of the district has been finished, and the work is now going on at the rate of one thousand feet a night, no work being done during the day to avoid interruption to traffic. Since the contracts for material were made last spring the prices have gone up, and many of the contractors delay carrying out their agreements. Suits have been begun against some of them. In the matter of copper wire, the large consumption by electric-lighting companies in the last two years has resulted in raising the prices to unreasonable figures. Major Eaton, of the Edison Company, estimated to-day that the company had used two hundred tons of ingot copper since spring, and would continue to use about two million pounds a year until the work in this city was done. The contracts for iron tubing stipulated that it should all be delivered by the 15th of August, whereas no one knows now when the work will be done.

The difficulty in getting boilers has also been one of the chief troubles of the Edison Company, the boilers furnished last month proving to be defective, owing to errors in construction resulting, as alleged, from hurried work. It is therefore now probable that the work of putting down mains will have to be suspended when frost sets in and the lighting of the down-town district postponed until spring. During the winter material can be stored up and the machinery made ready to begin lighting upon a large scale in April. Several buildings which want the Edison lamps sooner than that and have steam power at hand have contracted for the use of the proper machinery and will not wait for the street mains. Mr. Bennett signed a contract the day he sailed for Europe, providing for the introduction of 653 lamps in the *Herald* building; the boilers and dynamos will be placed in the Bennett building in Ann Street, the mains now running under Fulton Street. Provision is also to be made for the use of twenty-five-horse power of electricity for the running of small presses, wetting-machines, etc. Wallack's Theatre will not be lighted by electricity because Mr. Wallack considered the price demanded for the use of the patent (said to be $15,000) exorbitant. Major Eaton said to-day that to sell Mr. Wallack the right to use their light during the life of the Edison patents would be injuring the regular business of supplying customers from a central station. He was sure that eventually Mr. Wallack would use the Edison light when it was brought to his door just as gas is now, and the company's price for the use of the patent will have to be sufficiently high to equal the profits of many years' consumption of electricity. Especially in theatres would the small incandescent lamp of Edison be indispensable, because any number of lights can be placed in all sorts of positions, up in the flies or under the stage, or in the middle of fountains, without the necessity of running cumbrous gas-pipes or the slightest danger from fire.

The Edison Company have just received news through Mr. Henry Villard, who has recently returned from the Pacific coast, of the perfect success of one of the first of the company's experiments in practical lighting. In May, 1880, the company put a number of their lamps in the *Columbia*, one of the Oregon Navigation Company's steamships plying on the Pacific coast, and the lamps are still in use and give perfect satisfaction.

Mr. Edison has been for several weeks at Menlo Park, working at the lamp with a view to making it last longer than at present. He is also finishing his machines for the electric railway two miles long which has been built across-country near his factory to demonstrate to railroad men the practicability of electricity as a motive power. One Western road has invited Edison to make electric engines for a branch road fifteen miles long, and Edison has accepted. This will be many times the length of the Siemens road near Berlin.

Mr. A. A. Hayes, Jr., the secretary of the Brush Electric Light Company in this city, said this morning that his company was suffering like all others from the impossibility of getting machinery. Their new building in Elizabeth Street, near Prince, is one hundred feet square, and will be the finest "station" yet built; but the machine men are all behind, and the Brush company cannot furnish any more lights until they can get more machinery. At present they are running 550 lamps, their wires covering an area of several square miles. An important feature of the business is getting to be the lighting of dark stores and basements where a light for distinguishing colors is required. Ninety lamps are now in use down-town, and the whole force of 500 lamps could be used if the current for the up-town lights was not needed long before business hours were over down-town. Since the excitement about fire from electric wires the Brush Company have had all their wires taken from house tops and placed on poles of their own.

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THE EVENING POST: NEW YORK, DECEMBER 1, 1881.

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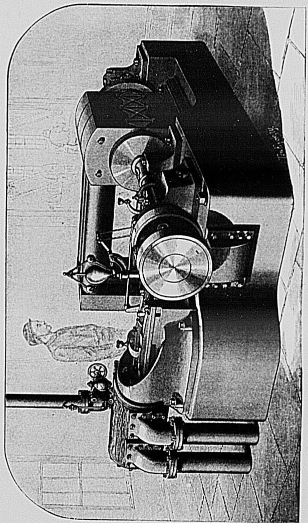

EDISON'S STEAM DYNAMO.

VAN NOSTRAND'S

ENGINEERING MAGAZINE.

NO. CLVI.—DECEMBER, 1881.—VOL. XXV.

INCANDESCENT ELECTRIC LAMPS AT THE INTERNATIONAL EXHIBITION OF ELECTRICITY.

By the COUNT DU MONCEL.

Translated from "La Lumiere Electrique."

In a previous article* we indicated in what case this system of Electric Lighting was specially applicable, and we saw that henceforth, thanks to important improvements recently introduced, it could be employed for the interior of houses, where light of feeble intensity is used; we have seen that several castles in England were lighted in this way, and that a certain number of houses in the city of New York had subscribed for the light furnished by the Edison Electric Light Company. Since the successful introduction of these lamps a great number of systems of the same kind have been brought out by different inventors, and without speaking of such well known ones as those of Edison, Swan, Maxim, Lane, Fox, Sawyer, we know of about fifteen inventions, bearing more or less upon the subject. It, therefore, seems to us an opportune moment to enter into circumstantial details about this method of lighting, which, up to this moment, has not excited any great interest in Europe, for various reasons which we have enumerated in different articles published in this journal at the commencement of the year 1880, of which the principal one was the relative considerable expenditure of motive force to produce a light of given intensity. It should be borne in mind that the luminous power of an incandescent body increases in a much greater ratio than the calorific intensity; therefore, by the very fact that incandescent lamps permit a greater division of the electric light, a loss is caused by the weakening of the radiating power resulting from the same. Nevertheless, the satisfactory results recently obtained force us to pass these systems of electric lighting in series, and we will begin naturally enough with that of Mr. Edison, which has made the most noise in the world, and which has attracted attention to this manner of lighting by electricity.

EDISON'S SYSTEM OF ELECTRIC LIGHTING.

The incandescent system was first represented by lamps made from an incandescent platinum wire, and the interesting experiments made in 1879 by M. de Changy, should be recollected; but the practical workings of this system were not satisfactory, principally because of the disaggregation and partial fusion of the wires, and in spite of the numerous improvements brought to bear on this system by Mr. Edison, who, by one of the most ingenious of processes, had rendered them

* "La Lumiere Electrique," Aug. 20, 1881.

more infusible and harder, still they had to be absolutely rejected—at least for ordinary lamps. Then it was suggested to employ carbon which, if not allowed to burn, is infusible in the highest heat developed in the lamps, and different arrangements of apparatus were put together at various times by King, Lodyguine, Bouliguine, Swan, Sawyer, etc., some avoiding combustion by enclosing the lamps in receptacles where a vacuum had been obtained, others by filling these receptacles with gases unfit for combustion, as nytrogen or oxide of carbon, or simply by leaving the air shut up in the receptacle to be vitiated by an incipient combustion.

All these attempts had but partially succeeded, to say nothing more, when, in 1879, the new incandescent carbon lamp of Mr. Edison was announced, and many savants, and myself in particular, doubted the exactness of the allegations which came to us from America. The carbonized paper horse shoe appeared incapable of resisting mechanical shocks, and of supporting incandescence for any length of time. At this epoch Mr. Swan himself said that up to that time he had not been able to obtain any very satisfactory results by an analagous disposition of the incandescent organ.

Mr. Edison, however, was not abashed, and in spite of the lively opposition made to his lamps, in spite of the bitter polemic of which he was the object, he did not cease to perfect it for practical purposes, and has at last produced lamps, which we have seen at the Exposition, and which can be admired by all the world for their perfect steadiness. These lamps, to the number of 160, light the two salons reserved for the discoveries of the ingenious American inventor, and we shall see still more important results upon the installation of the great machine which is expected from America.

As at present made, these lamps are sufficiently solid and can last a long time. The originally fragile carbon has become extremely elastic and hard, and of such attenuation that it can be well compared in size to a horse hair. By a cleverly combined system of fastening the platinum, conducting wires are not exposed to be cut, and they are so sealed in the glass receiver that their change of volume under the action of heat does not endanger the perfection of the vacuum. By the way the carbons are treated when the vacuum is made in the globe, the bubbles of air enclosed in their pores and which, in escaping, disaggregate the surface, are evacuated before closing the lamp, and at the same time the filament of carbon acquires a peculiar density and hardness, as was the case with the platinum wires. To obtain this result the carbonized filament must be brought into incandescense while the vacuum is being made. The very nature of the substance of vegetable origin employed in its fabrication, has been modified.

Fibers of bamboo are now used instead of the paper originally employed. These are carbonized by a certain process, and the successive transformation of these fibers into carbon filaments may be followed in several collections to be seen at

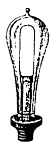

Fig. 1.

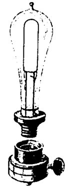

Fig. 2.

Mr. Edison's exposition, and which will gratify the curious, and are worthy of study. According to Mr. Batchelor and Mr. O. A. Moses, co-laborers of Mr. Edison, and who represent him at the exposition, the resistance of these filaments is 125 ohm, when brought up to an incandescence corresponding to 16 candles; but it can vary according to the luminous power desired of the lamps, for it can be distributed between two lamps, whose filaments are correspondingly more or less long. Their extremities, which are

enlarged, are pressed in a kind of pincer which terminates the platinum conductors, and which are soldered by an electrolytically deposited copper. Figs. 1, 2, 3 and 4 represents the actual arrangement of these lamps. Their duration, from what I have been assured, is long enough; however, they must wear out. Although most of them may have served for 1,200 hours, the question may be asked whether a lamp capable of deterioration may be considered a practical thing; but if it is considered that this lamp can be furnished for 30 cents, that the adjustment on its support cannot be any simpler than

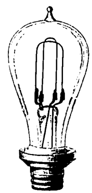

Fig. 3.

it is, which is evident on inspection, it is easily seen there is no more trouble to replace one than to renew a broken lamp shade.

What constitutes Mr. Edison's system is not alone his lamps, it is the totality of the arragements referring to them and which have attained such a degree of simplicity that henceforth nothing remains to be desired in practice. Generating machines, distribution of circuits, installation, indicating and regulating apparatus, meters for measuring the amount of current employed are all combined for immediate application. As we have said, this application is about being made in a part of the city of New York, where a great number of houses are to be lighted by this system, by means of a subterranean distribution from a central station, from which also motive power will be distributed to the houses.

This central station will be provided with twelve steam engines of 150 horse power each, actuating dynamo-electric machines, each of which will be capable to supply, it is said, 2,400 lamps of 8 candle power. The current furnished to these lamps comes through a branch taken before each house from the large-sized conductors laid in the streets. These deviations bring the poles of the

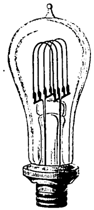

Fig. 4.

generator into each house, where the lamp wires can be brought in connection with them, thus rendering each house independent of any other, both for a supply of light and motive power.

When it is considered that the system of distribution adopted by Mr. Edison, the total resistance of the exterior circuit is extremely reduced and that with 2,400 lamps it is only $\frac{64}{2,400}$, say, about .026 of an ohm, it can be seen that a very feeble resistance should be given to the generating machine; so that its first arrangement has been modified. To begin with: The field magnets were arranged on a derivation taken from the commutator, putting it into the induced circuit as in Wheatstone's and Siemens' system. Then the armature was arranged on Sie-

mens' principle, so that the wire consisted of bars of copper. These bars lie close to each other around the cylinder which forms the armature, and they generate the current. Their extremities correspond to discs of copper (at right angles to them) laid one against the other at the ends of the cylinder, and insulated from each other. Each bar is fastened to its corresponding discs in such a way as to form a single circuit enveloping the cylinder longitudinally, and which is made perfect through the coupled bars two and two with the commutator blocks (made after the Grammes pattern). Figs. 5 and 6 give an idea of this new arrangement. The center of the cylinder itself is occupied outside of the rotating axle by a cylinder of wood, which, in its turn, is surrounded by a thick tube made of a series of very thin discs of iron, separated from each other by tissue paper. This arrangement facilitates the rapid changes of polarity in the plates. This tube is terminated at its two extremities by two thick clamping discs which are made to compress the others lsterally, and the copper discs of the working coil occupy the two compartments at the extremities of the cylinder, as seen in Fig. 5. Under such conditions as these the resistance of the generator is small, and permits of great subdivision of the current in multiple arc; nor is there any insulation to be burned, and it is even possible, in case of the deterioration of the bars, to renew them easily, for they are simply screwed against the copper discs corresponding to them. In the new disposition adopted by Mr. Edison, the field magnets lie horizontal instead of being placed in the vertical.

Fig. 7 represents the whole machine as now actually working in the Palais de l'Industrie.

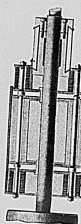

Fig. 5.

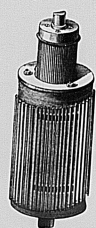

Fig. 6.

We have described the generating machine before completing the description of the system of distribution of the current, because we ought to speak of the system of control used in making the current uniform when its intensity has been modified by a variation in its distribution; that is to say, following after a variation resulting from the unexpected suppression of a certain number of lamps in a part of the system. The necessities of this system are easily understood, if we consider that this suppression can lead to a greater or less increase in the intensity of the current feeding the remaining lamps.

In France several systems have been

devised to obtain an automatic regulation, but in America, it seems, it is preferred to effect this by the intermediation of an appropriate controlling agent.

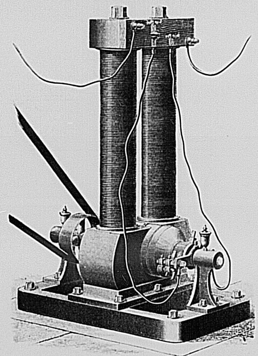

Fig. 7.

In this system, in whose general arrangement we see, in Fig. 8, the current which feeds the lamps furnishes a deviation at the machine *ee*, which enters an electric dynamometer, after having gone through a resistance of 180,000 ohms. The electro-motive force should be about 110 volts, and a difference of one volt should correspond on the scale of the indicating apparatus to three divisions; consequently, for each observed increase of intensity a resistance capable of compensating for it should be introduced into the circuit. Mr. Edison has established a circular commutator *e* with bobbins of different resistance, which permits of an increase of resistance, not in the lamp circuit, which would lead to a loss of work, but in the circuit of field magnets, which weakens their action on the working coil. From the central station also, the condition of the current affecting the lamps can be controlled by means of a testing photometer, which enables us to see how much the intensity of the current must be diminished or increased to correspond to a given luminous intensity. For this purpose the photometer is

mounted on a little railroad, placed in a dark chamber; under and in front of it is placed a scale, arbitrarily divided, so as to indicate immediately the candle

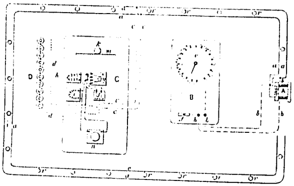

Fig. 8.

power furnished by the current in its normal condition. The left side of Fig. 8 indicates the manner of arrangement of the testing bench, with the explanatory

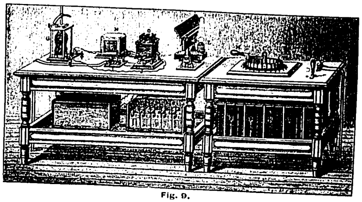

Fig. 9.

table at the bottom of the figure. Fig. 9 shows it in perspective. The manner in which derivations are taken on the principal conductors merits especial mention. The conductors are composed of two rods of copper of hemi-cylindrical form, flat on one side and round on the other, which are enveloped in cylinders of insulating material, contained in small wrought-iron pipes, which are buried under the streets. To take a derivation the cable is laid bare at the spot where the branch circuit is to be established. The two conducting rods (coming from the main conductors) are cut and bent outwards and introduced into a clamp where they are soldered to the house wires, as shown in Fig. 10; but in order that no harm can be

done by two strong currents, one of these communications is made by intercalating a lead wire in the branch circuit, shown at the bottom of the figure, and which,

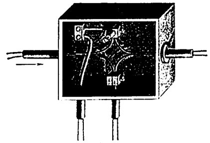

Fig. 10.

by its fusion, interrupts the circuit. This is what is called in America a "cut off;" and in this way it prevents deterioration. The box is then hermetically closed and covered with an insulating coating. In the figure the branch wires are shown

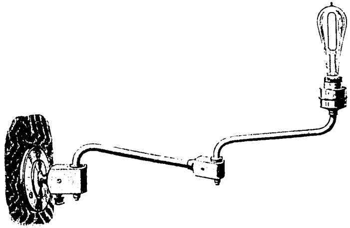

Fig. 11.

double, but it is evident that they could be single.

We said that all arrangements had been made to make the system a perfectly practical one, and of that we will soon be able to judge. Let us examine first how the lamp supports and the lamps themselves are disposed. As has been seen, they are formed of glass globes of ovoid form, cemented into copper sleeves by means of plaster and screwed into cylindrical cavities terminating the supports. These are a kind of arm which can be adapted to brackets or chandeliers, or be arranged around the walls. In the last case, the arm, as is shown in Fig 11, carry two articulations, A and B, and commutations are made by two plates of the hinges which are insulated, and in whose circular part two springs press, as seen in Figs. 12 and 13. Connections of the conductors with the lamp, as we have indi-

cated above, are made by a lead wire (cut off) which may melt and interrupt the circuit in case a too great quantity of current should endanger the lamp.

In these brackets, as in the three branch chandeliers, represented in Fig. 14, keys have been introduced which allow the extinction of the lamps separ-

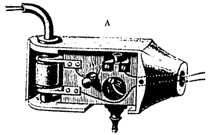

Fig. 12.

ately or together, without causing any spark of the point of rupture or any danger of fire. The movement of the key *a*, as shown in Fig. 12, breaks the contact by means of a conical stopper which terminates the screw of the key, and which, when separated from the two plates, through which the current passes when the stopper is in contact with them, breaks the circuits at the points and on

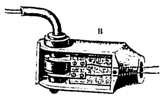

Fig. 13.

a surface of sufficient extent to greatly diminish the spark at the point of rupture.

The lighting of the two salons of Mr. Edison at the Exposition is done by 16 small chandeliers like the above, two grand crystal chandeliers and 80 brackets.

The effect is very beautiful, the steadiness being as complete as could be desired, and if, as I have been assured, the price of this kind of illumination is lower, light for light, than gas, it may be considered that the problem is on the eve of solution, for Edison's system of electric lighting is placed in the same condition as that of gas. He avoids the presence of machines in separate houses, which always are in the way, and which, by their very nature, require care and management not to be obtained from ordinary servants.

As a complement to his system, Mr. Edison has constructed portable chandeliers, represented in Fig. 15, and a current regulator shown in Figures 16 and 17, which permits of reducing the light in any desired proportion. It is a carbon rheostat, composed of carbon pencils of different sections, which, as the current passes through one or the other, allows any desired intensity. The apparatus is enveloped in a cylindrical cover, pierced with holes to allow of the escape of heat, and surmounted by a lamp which indicates to the eye the desired degree of luminacy. It is worked by a disc, shown separated in the lower part of Fig. 16, and which can be turned so as to bring a contact spring on any one of the supports of the carbon, whose position is indicated by an index and divisions engraved on the base of the cylinder.

But what is most interesting of all in those accessories of Mr. Edison's system, is the meter which determines the amount of electricity consumed by the lamps. There are two kinds, one automatic like a gas meter, the other requires weighing. They are, however, both founded on the same principle, that is to say, in the estimation of work by the

weight of a copper deposit produced by the current used. We will describe these two interesting pieces of apparatus hereafter, and give drawings of them; to-day we must be content with only mentioning the principle involved.

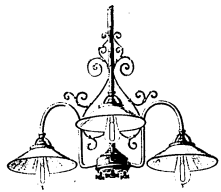

Fig. 14.

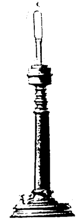

Fig. 15.

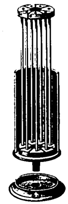

Fig. 16.

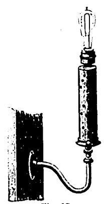

Fig. 17.

Imagine a balance having at the extremities of the beam two cylindrically rolled plates of copper forming two electrodes. Let us admit that these two systems of electrodes, which plunge into two vessels filled with a solution of sulphate of copper and furnished with fixed electrodes, are traversed in an inverse direction by the current employed, and which can cause the balance to operate under a given weight of copper deposited from the solution. It is easily seen that the movement brought about by these conditions can set in motion a current re-

verser, which can change the conditions of the deposits in such a way that the electrode, covered with copper, is transformed into a soluble electrode, while the one which was originally in that condition becomes the reducing electrode. From this time on an oscillating motion of the beam of the balance is established, and more or less frequently repeated, according to the rapidity of the formation of deposit, that is to say, according to the intensity of the current. As the same movement can bring about the passage of a derived current (taken from the total current) across a special electro-magnet, which commands the movement of a counter, it is easily seen (after the determination of the number of Amperes corresponding to the weight of the deposit, which produces the oscillation of the balance) what is the quantity of electricity consumed.

The realization of this idea has necessitated some electro-magnetic arrangements, which we will describe in detail when we get the drawings of the apparatus.

The other system is more simple, consisting of two voltameters of sulphate of copper, whose electrodes can be easily taken out and weighed, as the work done can be calculated from the weight of copper deposited. One of these voltameters is open to the subscriber, the other is kept closed by the controller. Resistance bobbins introduced into the circuit corresponding to these resistances, permits of the employment of greater or less periods of registration.

A small incandescent lamp placed beneath the apparatus, and which can be thrown into circuit by a simple metallic thermometer, prevents any danger of freezing in extremely cold weather.

There is another application of Mr. Edison's light, which can be seen at his exposition in a model intended for lighting galleries in mines. In this arrangement, represented in Fig. 18, the lamp is introduced in a glass receptacle filled with water and held in suspension. Communication of the apparatus with the circuit is arranged in such a way that the points of contact are covered by water, which avoids any danger of explosion in mines infested with fire damp.

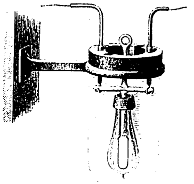

Fig. 18.

To give an idea of the application of Mr. Edison's systems, we have represented in the large engraving accompanying this article, Fig. 19, the interior of a parlor lighted by the small chandeliers previously described. As is seen, the electric light is projected downward, the best arrangement for reading and writing. This method seems to be preferred by Mr. Edison, but as can be seen above described that all styles of illumination can be produced with this kind of light, analogous to that obtained with candles or gas jets, it is simply a matter of taste.*

Mr. Edison's lamps are not alone employed in the two salons reserved for him, they are to be found in various places throughout the great nave, notably at the exhibits of Messrs. Heilman, Ducommun et Stienben (of which we gave a drawing in a previous article) and at the exhibit of Messrs. Sautter and Lemonnier. At these two places the currents are furnished by two Gramme machines, type A, and each one lights about 40 lamps. Now that Mr. Edison's great machine (a drawing of which is shown on frontispiece) has arrived at the Exposition, it will be possible to obtain, with the incandescent system, illuminations of greater magnitude. The landing of the great staircase will be lit in this way. It is proposed to accomplish this by means of a crystal chandelier of 144 lamps, and of others furnished with 25 lamps each, to be hung from the different panels, and of girandoles standing on the 16 pilasters of the staircase. This will produce an enchanting effect and a brilliant illumination. I am not quite sure that this mixture of arc and incandescent lights is a happy thought. It is evident that the latter destroy the effect of the former, and might lead one to believe that the luminous intensity of the incandescent lamp is less than it really is. Again, the difference in the color of the lights is so contrasted that many persons who reproach the electric for its ghastly aspect, find it too red in incandescent lamps. It is evidently an effect of contrast, for the light of incandescent lamps is whiter than that of gas jets, which, nevertheless, these same people find very agreeable. If required, incandescent lamps can give a dazzling white just as well as the others; it is only necessary to employ a stronger electrical intensity, then they lose their peculiar qualities, that of giving a soft light which does not fatigue the eye and of an easier and more complete subdivion.

It is certainly very difficult to satisfy everybody, and that many persons hardly know what they do want; above all, when the effects of contrast momentarily impair the power of judging correctly. On the other hand, there are certain fault-finding spirits who are never satisfied with anything; witness the author of that incomprehensible article that recently appeared in a certain journal, who pretended that only discordant sounds and puppet-show voices could be heard in the telephones from the opera. The author in question who could perpetrate such an enormity must have had his ear as sick as his humor. The crowd passing every evening before the telephone rooms at the Exposition, is the best proof of the inanity of such judgments, and by this can once more be seen the value of the scientific lucubrations of certain political journals.

The same thing happens with the electric light, and quite a number of persons who, without previous examination, and without being of the same opinion two days consecutively, come to us and disparage electric lighting. It is certain that new inventions have great difficulty in coming to light and in succeeding, above all when they are opposed by rival interests, but when they are really good they triumph in time over all obstacles.

We would like to give some information about Mr. Edison's new machines, but as they are not yet put up we reserve the description for another time; we will only say that the steam engine was constructed especially for this application, that it makes no noise, and that the dynamo-electric machine forms one of its integral parts. The field magnets of this latter-mentioned, in place of being vertical as in the model represented in Fig. 7, is horizontal, and the dimensions of the machine itself are much larger.

The steam engine, which works the machine, is of peculiar construction, and the speed of rotation which is communicated to the working coil is 350 turns a minute. This is not a very great speed, but the armature is very heavy, weighing, as we are told, over three tons and a half. The magnetic field in which it turns is formed by three powerful electro-magnets, united so as to form but one at their extremities.* In the salon of Mr. Edison are a collection of photographs, among which may be seen some of the manufactures where the enormous amount of

* For want of time the engraving referred to has not been reproduced. The idea is shown in Fig. 14.

* For description of Steam Dynamo (frontispiece) see end of article.

material required in these installations is constructed. As we have been assured, one of these turns out 2,000 lamps a day, giving occupation to 150 persons. In accompanying drawings and collections can be seen methods of glass blowing, the carbonizing of the filaments intended for incandescence, the vacuum pumps and the mounting and packing of the lamps. The pumps referred to are set in motion by dynamo-electric machines.

From all this, we see Mr. Edison's system to-day is completed, perfectly studied out in all its parts, and that nothing more remains to be done, but to introduce it on a great scale.

TH. DU MONCEL.

[Note by the Translator.]

DESCRIPTION OF EDISON'S STEAM DYNAMO.

(*See Frontispiece.*)

Peculiar to the Edison system is the idea of connecting an engine of great power directly to the armature shaft of a single dynamo, capable of absorbing the full power of the engine, and of economically converting the same into electrical energy for distribution to the lamps and motors. To obtain the requisite electrical pressure, and avoid the use of magnets and armature of a weight and size which for mechanical and commercial reasons would be excessive, the engine is so constructed as to maintain a speed of 350 revolutions. A boiler pressure of 120 lbs., made absolutely safe by the use of approved sectional boilers, the high speed, and variable cut-off valve, and manner of constructing the engine makes this method of generating electricity absolutely safe and economical, and the uniformity obtained in regulation of speed insures a corresponding steadiness in the current and therefore in the lights which it supplies.

The following approximate summary of weights and dimensions of various parts of the latest "steam dynamo" constructed will give an idea of its total size and power.

Cast-iron sole plate, in one piece, upon which dynamo and engine are placed, and pillow blocks, 9,600 lbs.; Magnets, complete, 24,500 lbs.; Armature, complete, and shaft, 8,500 lbs.; Engine, 10,000 lbs. Total weight, 44,600 lbs.

The total weight of copper on armature and magnets is 3,600 lbs.

Principal dimensions: Sole plate $12\frac{1}{2} \times 8\frac{1}{2}$ ft.; length of magnets, 8 ft.; length of armature (commutator makes additional length of 9") 5ft.; diameter of armature, 28"; Engine cylinder, 11" × 16"; capacity, 2,400 gas jets.

1783

1784

1785

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Centralzeitung für Optik und Mechanik.

diometers, sowie der Apparate, welche zu seinen Arbeiten über die strahlende Elektroden-Materie dienten.

Das russische Telegraphen-Departement hat eine grosse Anzahl von Blitzableitern verschiedener Konstruktionen ausgestellt, daneben Dräthe, Apparate, Isolatoren und Nebenapparate. Sehr schöne Reliefplatten der Specialkarte von Russland hat die topographische Sektion des Staatsraths ausgestellt, ebenso erregen die galvanoplastischen Reproduktionen der Staatsdruckerei für Papiergeld unsere Aufmerksamkeit, unter ihnen die Copie der ersten von Jacobi hergestellten galvanoplastischen Reliefplatte, welche derselbe am 5. Oktober 1838 der Akademie der Wissenschaften in St. Petersburg überreichte; für das Gelingen seiner Versuche wurde Jacobi mit 25000 Rubel belohnt.

Wenig Bemerkenswerthes bietet die spanische Ausstellung dar, deren Apparate zum Theil französischen Ursprungs zu sein scheinen. In der norwegischen Abtheilung fallen uns die elektrischen Apparate von Steger in Christiania, sowie die gut gearbeiten Schiffs-Kompasse von Godager in Frondhjem auf, in der schwedischen Ausstellung dagegen zeichnen sich die Telegraphen-Apparate durch ihre vorzügliche Arbeit aus, welche theils die Telegraphen-Verwaltung selbst, theils der Mechaniker Sörensen in Stockholm ausgestellt hat. Letzterer hat auch einen Meteorograph nach dem System Theorell aufgestellt, welcher die Angaben der auf dem Dache des Industrie-Palastes errichteten meteorologischen Instrumente, Thermometer, Anemometer und Barometer, registrirt. —

Die holländische Ausstellung umfasst nur einen kleinen Raum; erwähnenswerth sind die Apparate von Dr. Kayser in Leyden und von H. Olland in Utrecht, doch vermissen wir leider des letzteren Telemeteorograph, eine Verbesserung des in der belgischen Abtheilung ausgestellten Apparates von Vau Rysselberghe. In der historischen Ausstellung des Teyler-Museums in Haarlem erblicken wir die grosse Elektrisirmaschine, welche Vau Marum im Jahre 1785 von Cuthberson in Amsterdam herstellen liess, mit zwei parallelen Scheiben von 1,62 Meter Durchmesser, dazu eine Batterie von 24 grossen Leydener Flaschen von 12,6 Quadratmeter Oberfläche, welche Vau Marum benutzte.

Die Schweiz bringt in den allgemein bekannten vorzüglichen Apparaten von Hipp in Neufchâtel einen schätzenswerthen Beitrag zur Ausstellung, unter diesen ist das Chronoskop besonders zu erwähnen, durch welches Tausendstel Sekunden gemessen werden können. Meteorologische Registir-Instrumente, als Baro-, Thermo-, Hygro- und Anemorograph hat G. Hasler in Bern ausgestellt. — Merkwürdiger Weise finden wir in der schweizer Ausstellung auch die schönen auf elektrolytischem Wege hergestellten Farbstoffe von Professor Dr. Fr. Goppelsröder in Mühlhausen im Elsass.

Die dänische Telegraphen-Verwaltung hat neben einer Büste Oersted's den von demselben zu seinen Grundlegenden Experimenten über den Elektromagnetismus benutzten Kompass ausgestellt.

Zuletzt erregt unser besonderes Interesse ein kleiner Tisch mit der Ueberschrift „Japan", auf welchem wir Gefässe für Elemente, sowie Isolatoren finden. Im Jahre 1869 wurde die erste Telegraphenleitung in Japan gelegt und jetzt haben die Leitungen des Landes bereits eine Gesammtlänge von 3000 Kilometer erreicht. Früher war die Telegraphen-Verwaltung Japan's gezwungen, die wegen ihres Umfanges grosse Frachtkosten verursachenden Batterie-Gläser aus Europa kommen zu lassen. Im Jahre 1873 gelang es einem Porzelanfabrikanten Tukagawa in Arita, welchen die japanische Regierung dazu aufgefordert hatte, brauchbare Isolatoren und poröse Zellen aus rothem Thon herzustellen, während ein anderer Fabrikant Kano in Shirakawa die Batteriegefässe aus Porzelan machte. Merkwürdig sind ausserdem die von einem japanischen Telegraphen-Beamten erdachten Gefässe aus Papier und Leinwand, welche, durch japanischen Lack verbunden, schichtweise über einander gewickelt sind und äusserst widerstandsfähig sein sollen; sie werden in der japanischen Militär-Telegraphie ausschliesslich angewendet. So hat selbst Japan, den Fortschritten europäischer Kultur mit raschen Schritten folgend, eine interessante und vielleicht praktische Neuigkeit in die elektrische Ausstellung gebracht.

READ.

RE.

Die Ausstellung Edison.

Zwei grosse Säle des ersten Stockwerkes des Industrie-Palastes sind dem amerikanischen Erfinder Edison eingeräumt worden, welcher hier den Fachgelehrten und dem Publikum Europa's Gelegenheit giebt, sich durch den Augenschein über die zahlreichen von ihm konstruirten elektrischen Apparate und Instrumente zu unterrichten, über welche bereits durch die Zeitungen so viel Wahrheit und Dichtung berichtet worden ist.

Die beiden Säle sind gefüllt mit einer grossen Anzahl von Apparaten und Instrumenten, unter welchen allerdings einige von hohem Interesse sind, doch ist auch manches Nebensächliche von Amerika herüber geschafft worden, um das Bild der Edison-Ausstellung zu vervollständigen.

Besonders dankend müssen wir konstatiren, dass uns wohl kaum in einem anderen Theile der Ausstellung mit solcher Liebenswürdigkeit und Bereitwilligkeit über Alles Auskunft ertheilt wurde, wie in den beiden Sälen Edison's von Seite seiner Angestellten.

Wir finden hier eine Reihe verschiedener Telephone, unter denen das Edison'sche Kohletelephon und sein Elektro-Motograph hervorgehoben zu werden verdienen. Von ersterem sind eine Reihe von Versuchen dargestellt, welche den Erfinder zur jetzigen Form dieses Apparates geleitet haben. Bei demselben wird der Strom eines Elementes angewendet, so dass die schwingende Membrane nur die Aufgabe hat, Schwankungen in seiner Stärke hervorzurufen. Edison benutzte zuerst, im Jahre 1878, die Veränderung des Leitungswiderstandes der Kohle bei den durch die Schwingungen der Membrane hervorgerufenen Druckveränderungen zur Uebertragung gesprochener Worte. Es ist dieses dasselbe Princip, welches der grossen Anzahl von Mikrophonen zu Grunde liegt, welche jetzt überall als Empfänger bei telegraphischen Anlagen benutzt werden.

Durch dieses Verhalten der Kohle kam Edison auch zur Konstruktion seines Mikrotasimeter. Ein an einem Ende fester Metallstab drückt mit dem anderen Ende gegen eine in einen Strom eingeschaltete Kohlenschicht und die geringsten Aenderungen in der Länge des Metallstabes rufen Stromschwankungen hervor. Man kann deshalb mit dem Mikrotasimeter sehr geringe Temperaturveränderungen konstatiren, wie denn Edison wirklich mit diesem Instrument die Temperatur einiger Sterne bestimmt haben will, indem er dasselbe an den Ort des Sternbildes in einem Fernrohre brachte.

Ein anderer interessanter Apparat ist der Elektro-Motograph. Um die Wirkung desselben zu erläutern, ist folgender Demonstrationsapparat daneben ausgestellt. Der wesentliche Bestandtheil desselben ist eine Schicht Kreide vermischt mit essigsaurem Quecksilberoxyd und Soda, welche stets etwas feucht zu halten ist. Diese Schicht bildet den einen Pol einer Stromleitung, während der andere durch eine Platte aus Platinblech gebildet wird. Streicht man mit letzterer über die Kreide hinweg, so fühlt man deutlich, dass in dem Augenblicke, wo der

The Daily Telegraph. 1790

FRIDAY, DECEMBER 2, 1881. *London.*

BY PULLMAN TO BRIGHTON.

Travellers by the London, Brighton, and South Coast Railway have become, by this time, tolerably familiar with the aspect of the Pullman Drawing-room Cars, which form such agreeable adjuncts to certain express trains between the metropolis and the queen of watering places. The passenger is only called upon to disburse eighteenpence in addition to his first-class fare; and the payment of this moderate surcharge entitles him to become the occupant during his fifty-two miles journey of a luxurious fauteuil in a tastefully-fitted saloon, in which he may take, when he feels so minded, gentle walking exercise, and which is in communication with a cosy smoking compartment. It is, however, a very extensive and, so far as this country is concerned, a wholly original development of the drawing-room car system that has just been, with most gratifying success, introduced on the Brighton line. Yesterday, at 11.25 a.m., the "Pullman Limited Express," composed of four splendid cars, named respectively "Maud," "Victoria," "Beatrice," and "Louise," and drawn by the locomotive engine Stephenson, left Victoria Station for Brighton, conveying a party of nearly 100 ladies and gentlemen, who, at the invitation of the directors of the company, were about to take a novel and interesting trip, altogether à l'Américaine. The gathering was, in more than one sense, a highly representative one; and among those present may be mentioned the Right Hon. Hugh Childers, M.P., Sir Arthur Otway, M.P., Mr. J. H. Puleston, M.P., Mr. H. Edwards, M.P., Mr. Brydges-Willyams, M.P.; General C. S. Hutchinson, Inspector of Railways; Mr. T. H. Farrer, Secretary, and Mr. C. C. Trevor, Assistant-Secretary to the Board of Trade; Captain Gosset, Serjeant-at-Arms; the Rev. Monsignor Capel; Mr. T. Swinyard, President of the Dominion Telegraphs Company of Canada; Mr. Yeomans and Mr. Roberts, representing the Pullman Car Company; M. Philippart, Mr. Percy Knight, Mr. E. Yates, Mr. Jonas Levy, the deputy-chairman; Mr. Bannister, the engineer; Mr. Stroudley, the locomotive superintendent; Mr. Philip F. Rose, the solicitor; and Mr. J. P. Knight, the general manager of the London and Brighton Railway, together with a large number of gentlemen practically interested in railways, and in the progress of electrical science. As the Pullman Limited Express sped on its course, which for the down journey was by the Dorking, Horsham, and Steyning line, there kept pace, almost "pari passu," with the speed of the train that which may be described as a most remarkable transformation scene. England appeared to have been left behind at Victoria, where at the various platforms trains of the ordinary kind were arriving and departing, where the ordinary compartments were being filled with or emptied of smoking and non-smoking passengers, and where doors were being banged in the usual manner. The first stage of the transformation was the rapid and yet noiseless manner in which it received its complement of guests. The commodious aisle or gangway between the seats enabled the five score ladies and gentlemen to bestow themselves with care and comfort in the places which they severally preferred to occupy, and the sensation of "bien-etre" thus produced was undeniably heightened by the knowledge that the cars were not so many cellular vans grimly locked up, but were accessible between themselves, from end to end of the train. Thus, the car "Maud," which will always be placed in the front of the train leaving Victoria, and in the rear of the train leaving Brighton, consists of three compartments, the largest of which is for smoking, and contains twenty-two seats and four chairs, in all sitting accommodation for twenty-six passengers. Next to this is a compartment with six seats, intended for passengers' servants, and beyond this, again, the compartment for the guard and the luggage. Next is the parlour and restaurant car "Victoria," which may be considered as the head-quarters of the train: and here the Transformation Scene made itself manifest in its most curious aspect. An elegant and commodious bar counter has been erected; and from this "buffet" were distributed yesterday by swift-footed and neat-handed pages a liberal supply of creature comforts, both of a liquid and of a solid nature. It is intended, when the Pullman Limited Express begins to run as a regular train, which it will begin to do next Monday, making two down and two up journeys between Victoria and Brighton in the course of every day, to sell only such light refreshments as sandwiches, meat pasties, cakes, biscuits, buns, and so forth. For a journey to Brighton, a city superabounding in hotels and restaurants, it would be simply absurd to provide soups and joints and the other elements of a regular lunch or dinner. It would not, on the other hand, be held abnormally absurd to allow such travellers as are not members of the United Kingdom Alliance or the Order of Good Templars to indulge in such beverages as sherry, champagne, claret, and beer, or even to correct the acidity of aerated waters by a dash of ardent spirits; but in view of the jumble and muddle of anomalies, inconsistencies, and irrationality, of petty tyranny, gross favouritism, and generally blundering and wrong-headed stupidity into which the Licensing Laws have drifted, the Board of Directors of the London, Brighton, and South Coast Railway have very wisely determined, for the present at least, to make no attempt to sell either wines or spirits on board their Pullman restaurant cars. A notice, however, will be posted up, informing travellers that if they require anything stronger than tea and coffee, Apollinaris and Wilhelmsquelle, lemonade and ginger-beer, as an accompaniment to their lunch, the conductor or his assistant will obtain such stimulants, of course on prepayment, from the refreshment rooms before starting. Looking at the rueful experience which the railway companies have already had of the "tricks and manners" of licensing magistrates this decision on the part of the Brighton Railway authorities can only be regarded as a very prudent one. They have not lost sight of the fact that the restaurant cars started with such bright hopes of success on the Great Northern Railway have been wantonly crippled in their mission of conducing to the comfort and convenience of the travelling public by a capricious refusal of a licence to sell wines and spirits. They have not forgotten that the Prime Minister promised redress for the act of silly and vexatious injustice thus done, but that teetotal narrowness gained the victory in the end, and that travellers on the Great Northern restaurant-cars are still forbidden to consume, in the way of liquids, anything stronger than ginger "pop." They have not forgotten that on their own Brighton line the justices have, year after year, refused a licence for the new refreshment-room at Worthing, on the building of which they have expended many thousands of pounds; while an analogous act of despotic churlishness has prevented them from providing adequate refreshment facilities for the public at the new Polegate Junction, the plea in extenuation for the denial of the licence being that there was "a public-house close by." The predominant hallucination of the teetotal enthusiasts seems, however, to be that, were Pullman restaurant cars licensed, they would be forthwith utilised by desperate topers, determined to indulge, at any cost, in their ungovernable appetite for strong drink. Now, the existing fare for a first-class express ticket between London and Brighton is seventeen shillings and sixpence. It is intended to make the fare, by the Pullman Limited Express, twenty shillings. He must be a desperate toper indeed who would be willing to pay a pound sterling merely as admission fee to a tavern on wheels, entitling him to tipple incessantly during a period of, say, one hour and fifteen minutes. He could tipple at a much cheaper rate on board a penny steamer between London Bridge and Chelsea Reach.

In the "Victoria" or restaurant car are also a newspaper and periodical stand and a letter-box; and here, likewise, are electrical discs and a bell indicating in what part of the train the presence of the attendant is required. A barometer, a thermometer, and a clock complete the Victorian "agréments." Next comes the drawing-room car, "Beatrice," containing twenty-one seats, in the form of revolving chairs. This is to be normally a "ladies'" car, and will be set apart for ladies travelling alone or escorted by gentlemen. The last car, the "Louise," is arranged similarly to the "Maud," with the exception that it will not be used for smoking. The entire train, together with the engine, is fitted with the Westinghouse automatic brake; there is direct communication between the guards at the front and rear of the train, and between the guards and the engine driver; and the whole train is warmed by "Baker's heaters," a continuous circulation of hot-water pipes which can be regulated at will. It was in one of the angles of the guard and luggage compartment attached to the last car, the "Louise," that perhaps the most novel and the most wonderful feature of the Pullman Limited Express was yesterday noticeable. The whole train is lighted by electricity; the system employed being the Edison incandescent lamps in connection with Faure's accumulators. The angle of the compartment just alluded to is a commodious little cabin fitted with [illegible]at and compact apparatus for the storage of the mighty power of electricity. You seem at first to be gazing at so many rows of black japanned cash-boxes, one on the top of the other, and placed close together; but on nearer inspection you find that these metallic cases are fitted with plates arranged after the manner of magic-lantern slides. These slides are of lead, coated with red lead, wrapped in coverings of felt, and kept saturated with a weak solution—about 10 per cent.—of sulphuric acid and water. In these leaden plates the electricity is stored. Thirty-four Faure's accumulators, weighing some fifteen hundredweight, were in use during yesterday's trip. They had been charged with electricity, by means of a "dynamo" machine on Wednesday night, at some premises in the Strand, and carted off on Thursday morning to Victoria; and, so charged, they might have been conveyed to Scotland or to the distant Continent of Europe. They did their usual work with unvarying efficiency throughout Thursday, and had enough electric power remaining to feed the lamps through another working day. Of the success in producing the illumination of the train, it will suffice to say that in one car, containing twenty-six passengers, only four of the Edison lamps of "eight candle" power were suspended from the ceiling, and that by this light the smallest newspaper print might be read. The journey down was purposely made by the Dorking line for the reason that it is eminently a "daylight route," there being only two small tunnels, one on either side of Dorking; but these were sufficient to illustrate in a most remarkable degree the complete control which the electrician has over the incandescent lamps, be they Edison's or be they Swan's, fed by the agency of the Faure accumulators. Directly the train entered the tunnel the lamps were turned on. The very instant that the train emerged from the tunnel the lamps were turned off. The return journey was by the best-known and popular route, by Three Bridges, Redhill, and East Croydon; and, night having fallen, the intense but not too dazzling brilliance of the incandescent Edisons could be tested throughout the hour and a quarter's run to town. Leaving Brighton at 7.55 p.m., the company's guests by the Pullman limited express were safely landed at Victoria at ten minutes after nine, naturally delighted with their novel and interesting experience. It may be mentioned, in conclusion, that the new train has been in course of construction for more than twelve months, and that its introduction is not in any shape or form connected with the Balcombe Tunnel tragedy. The directors have simply started the train as an experiment additional to the single Pullman cars which have been working between Brighton and Victoria during the past five or six years. The new train has been constructed from the plans and designs of Mr. J. P. Knight, the general manager, and Mr. Stroudley, the locomotive superintendent, and was built at the Pullman Works, Derby, under the superintendence of Mr. H. S. Roberts, the European manager of the Pullman Company.

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1792 Dec. 2, 1881

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LIGHTING OF RAILWAY CARRIAGES BY ELECTRICITY.

Times London 2:12:81.

A trial trip was made yesterday by the new Pullman car train, which has been already described in *The Times*, and which under the name of the "Pullman Limited Express," will begin its regular service on the London, Brighton, and South Coast line, between the Victoria Station and Brighton, on Monday, the 5th inst. Single cars of the American pattern have been running on this line for five or six years, but this train is made up entirely of Pullman cars. These cars, of which there are four, have been constructed at the Derby works of the Pullman Palace Car Company, under the superintendence of Mr. H. S. Roberts the manager of the company in this country, the fitting up and arrangement of the cars being carried out after the designs of Mr. J. P. Knight, the general manager, and Mr. Stroudley, the locomotive and carriage superintendent of the London, Brighton, and South Coast Railway. The train includes a parlour car, a drawing-room car, with ladies' boudoir and dressing-room, a restaurant car, and a smoking car, while a compartment at each end of the train next to the luggage compartment is provided for servants. The cars are kept at an equable temperature by means of hot water pipes. There is electric communication between the parlour, drawing-room, and smoking cars, and the restaurant car, and in many ways the comfort of passengers is provided for. The most important and novel feature of the new train is, however, that it is lighted throughout by electricity. As the train entered Box-hill and other tunnels on the Dorking, Horsham, and Steyning route, by which the trip to Brighton was made, the cars were simultaneously, and by the mere turn of a handle, brilliantly lighted, and as quickly, when the train emerged, the light was turned off. On the return journey the cars were lighted all the way from Brighton to Victoria, the lamps burning with a steadiness undisturbed by the motion of the train. The trial confirmed the results of an experiment made some few weeks ago with a single car, and proved the possibility of satisfactorily lighting a whole train by electricity. The lamps used yesterday were Edison's incandescent lamps, of which altogether there were 29 distributed in various ways throughout the train, the drawing-room car being sufficiently illuminated with an effect of pleasantly diffused light by five of them. Each lamp was computed to be giving a light equivalent to that of nine or ten candles. As one of these Pullman cars is 58ft. 5in. long, the length of train to be lighted was over 233ft. The electricity was supplied by Faure accumulators, of which 80 where carried. Mr. W. Lachlan, the engineer representing the Société La Force et La Lumière, who was in charge of the batteries, reported that but 30 were brought into use on the down journey, and only a portion of the electricity stored in these was expended. On the up journey these and four fresh boxes were brought into operation. For the present the accumulators will be charged each evening at the society's depot at Charing-cross, but as soon as the necessary arrangements can be made it is intended that the recharging shall be done at Victoria with a dynamo machine worked by a small stationary engine. It is not improbable, however, that before long the electricity required may be generated on the train itself, the chief practical difficulty in the way of this saving of force arising from the unavoidable alterations in the speed of the train—a mechanical difficulty in the way of charging the accumulators in this way which the ingenuity of the electrical engineers will no doubt soon overcome. Among those who witnessed this interesting experiment were the Right Hon. Hugh Childers, M.P., Sir Arthur Otway, M.P., Mr. Puleston, M.P., Captain Gosset, Major-General Hutchinson, Mr. T. H. Farrer, Mr. W. H. Preece, Mr. S. A. Blackwood, C.B., Colonel Moncrieff, C.B., Monsignor Capel, Mr. Balfour Browne, Mr. Seymour Grenfell, Mr. Jonas Levy, deputy chairman of the London, Brighton, and South-Coast Railway, Mr. Philippart, president of the Société La Force et La Lumière, Mr. F. A. Pincoffs, and Mr. E. H. Johnson, the representative of the Edison Light Company in London. The Pullman limited express will leave Victoria every week day at 10 a.m., and 3 50 p.m. and Brighton at 1 20 p.m. and 5 45 p.m. On Sundays it will make but one journey each way, leaving Victoria at 12 30 noon, and Brighton at 9 30 p.m. the directors promise early next year to introduce experimentally the American luggage system between Victoria and Brighton for the benefit of passengers by this new train.

1794 Dec. 2, 1881.

THE BRIGHTON PULLMAN EXPRESS.

Standard 2:12:81.

A most delightful journey was made yesterday by a party of nearly a hundred guests, who were invited to the trial trip over the London and Brighton railway of the new Pullman Limited Express—the most superb and the finest equipped train in the world. The Directors of the Company are to be congratulated upon the complete success which has crowned the original conception of their General Manager, Mr. J. P. Knight, and the execution of the designs and details by their Locomotive Engineer, Mr. Stroudley. Nothing so magnificent, so perfect, and in which every possible want or comfort has been thought of and provided for, has hitherto been attempted. The train consisted of one of the Company's express engines, the "Stephenson," in charge of Mr. Percy Knight (the son of the General Manager), and the four special Pullman cars, "Maud," "Victoria," "Beatrice," and "Louise." Each is 58ft. 5in. in length from outside to outside of the overhanging platforms at each end, and a continuous passage is formed throughout the entire length of the train—233ft. 8in. The spaces overhead above the platforms are covered by canvas roofs. The parlour car "Louise" was placed to the front, next to the engine. It is divided into three compartments. The general body is fitted with seven fixed seats and two revolving chairs on each side, there being fixed tables between each set of seats. At the opposite end of the car is a lavatory and every convenience of a dressing-room. A well-constructed doorway leads out on the connecting platform; and the entrance to the adjoining carriage is similarly arranged. The second carriage, the "Beatrice," is fitted in the most elegant style as a drawing-room car. At one end is a ladies' boudoir and dressing-room; at the opposite end are a store-room and locker. The general body of this carriage—which is, like the others, open throughout—is furnished with twenty-one revolving chairs, so placed that friends can sit together and converse. This part of the train is reserved for ladies travelling alone, or accompanied by gentlemen. The "Victoria" is a restaurant car, fitted with a lavatory, store-room, and locker at one end, and a nicely-arranged bar counter at the other end, which was yesterday decorated with plants and flowers, and provided also with accessories which appeal to the palate rather than to the eye. The car "Maud" is devoted to the smokers. At one end are lavatory arrangements, and at the other the guard's and luggage compartment, and in this compartment also are placed the eighty electrical Faure accumulators which supply the light to the numerous Edison incandescent lamps by which the train was lighted throughout its entirety. The seats in the main portion of this car, as in the others, are fixed on each side of the central passage, with tables between each set. The seats in all the cars are placed against the windows, which are closed and triplet in arrangement, and furnished with separate blinds. The ventilation is obtained by louvre windows in the roof. All the internal fittings are of walnut wood, with deep red Utrecht velvet cushions, the backs of the seats in the drawing-room and parlour cars being covered by white antimacassars. The panellings, seat ends, and incised gilt ornamentation are in admirable taste, and the lofty interiors of the carriages permit even the tallest person to move freely about without stooping.

The start was made at 9.30 a.m., and the route selected was through Sutton, Epsom Junction, Leatherhead, Dorking, Horsham, Shoreham, and Hove, into Brighton, where the train duly arrived at its appointed time, 1.18. As the two tunnels were passed the electric lights, soft, steady, and bright, were flashed on, and as quickly flashed off as the train emerged into daylight again.

On the return journey, which was made along the main line by Three Bridges and Croydon, the entire train was lighted up, the drawing-room, parlour, and restaurant cars each by five pairs of incandescent lamps suspended with their reflectors from the roofs, and the smoking car by five single lights in similar manner. Anything more beautiful or more pleasant in the way of lighting it is impossible to conceive. The train is attended by two guards, a conductor, an assistant conductor, and page. At convenient intervals in the sidewalks of the carriages are studs for ringing the electrical bells placed in the refreshment bar, and on sounding any one of these attendance is at once given at the required seat. Along the floor there is a continual circulation of heat by means of hot-water pipes, and disposed in the carriage are a thermometer, barometer, and clock. There are also newspaper stand and letter-box provided, and telegraph forms, obtainable on request.

The train is provided with Westinghouse brakes—the best of all the brake systems. In fact, there appears to be really nothing needed for the requirements or comfort of passengers that has been overlooked by Mr. Knight. The train has been built at the works of the Pullman Car Company at Derby, and has taken nearly two years to construct. The licensing laws interfere with the sale of wines and spirits, and consequently, when the new train commences its regular service on Monday next, only tea, coffee, and effervescing waters, with light refreshments, will be obtainable, except by ordering before the departure of the train. The new Pullman Express will make two journeys each way per day—from London, at 10.0 a.m. and 3.50 p.m., returning from Brighton at 12.0 noon and 5.45 p.m. Amongst the party yesterday were Mr. Childers, Secretary of State for War; the Deputy Chairman of the Company, Mr. Jonas Levy, Mr. Otway, M.P., and other Directors; Mr. J. P. Knight, the General Manager; Mr. Stroudley, Locomotive Engineer; Lieut. Colonel Moncrieff, Mr. W. H. Preece, Mr. Westinghouse, Mr. Henry Edwards, M.P., Mr. C. Trevor, of the Board of Trade, Sir Alex. Wood, and others.

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London. 2:12:81.

THE DAILY NEWS,

NEW PULLMAN CAR TRAIN.

To take the Pullman car train to Brighton has hitherto signified to travel by a train of which the Pullman car formed part. After Monday next there will be on the London, Brighton, and South Coast Railway a veritable Pullman car train—a train that is nothing but a suite of Pullman cars. This will be distinguished by the name of "the Pullman Limited Express." Judging from the trial trip made yesterday it would not be misnamed a limited and luxurious express. Entering it you enter a mansion on wheels. You can roam about from parlour to drawing-room, dining-room, and smoking-room. The ladies have also a boudoir. Servants are at your call by electric bell; but you need not call for light or fire. A pleasant and equable temperature is maintained by hot-water pipes, and lighting up is done before there is time to demand it. No sooner do you enter a tunnel than the bright but soft and equal light of the Edison electric lamp is shed all over the compartments. It noiselessly comes at the moment it is needed, and is as quietly gone when the need for it is over. It beats the good fairy of nursery lore, for it needs no summons. It is with you before you can as much as think of a wishing cap, and it is itself a magic lamp. Going to a home at Brighton, you are almost as good as at home the moment you are seated in the train; while coming to London you have little reason to think yourself out of your house till you step on the platform at Victoria. Accordingly, with this train service Brighton may well come to be more appropriately than ever considered as London-on-Sea.

The introduction at this particular moment of a train of cars en suite, with such perfect lighting arrangements, is apt to be associated with thoughts of a recent tragedy; but the directors of the railway company are obviously entitled to the credit of conceiving this improvement in the railway service of this country without any suggestion from such an event as the Lefroy murder. The train, as will be readily believed by those who see it, has been under construction at the Pullman works, Derby, for more than twelve months. It is the design of Mr. J. P. Knight, the general manager, and Mr. Stroudley, the locomotive carriage superintendent, worked out under the superintendence of Mr. H. S. Roberts, the European manager of the Pullman Car Company. To Mr. Knight also, we understand, is due the idea of lighting the train by electricity—an idea the feasibility of which was rendered evident to him on his hearing of Sir W. Thomson's experiments with the Faure accumulator and on his witnessing at Paris the success of the various systems of electric lighting by incandescent lamps. The train, a worthy realisation of an enterprising design, was brought up to London Bridge on Wednesday for the inspection of the directors, and yesterday it made its trial trip from Victoria, freighted with an influential and critical company. The route taken was the, for express passengers, the unusual, but decidedly picturesque way of Epsom, Dorking, Horsham, and Shoreham. Mr. Childers, the Secretary for War, travelled with the new train as far as Sutton. The Serjeant-at-Arms of the House of Commons (Captain Gossett), Sir A. Otway, M.P., Sir R. Palmer, Mr. Puleston, M.P., Mr. H. Edwards, M.P., Monsignor Capel, Colonel Moncreiff, C.B., Mr. Balfour Browne, Mr. C. S. Grenfell, and others took the trip to Brighton and back again by the direct route. Mr. Farrer and Mr. C. Trevor represented the Board of Trade, whose chief surveyors were also present. The Post-office Department was well represented. Mr. Blackwood, Mr. W. H. Preece, Mr. C. B. Patey, Mr. E. Graves, and Mr. A. Benthall were all in the train. Major Flood Page, of the Crystal Palace, and one of the directors of that institution, Mr. George, were naturally interested in seeing one of the triumphs of that science the progress of which is to be by-and-bye demonstrated at Sydenham. Mr. Edison's representative in this country, Mr. E. H. Johnson, was also among the company, and the Société de la Force et la Lumière, whose interest in the undertaking had special reference to the behaviour of the Faure accumulator, was represented by Mr. S. Phillipant, Mr. Pincoff, and Mr. Lochlan, the last named being the engineer in charge of the light. Ordinarily, it should be explained, the light need not be under special charge, but may be switched on and off by the engine-driver or guard. The directorate and official staff of the railway company, it will be understood, were properly represented at the inauguration of the new and important service, and the engine, which is named Stephenson, was in charge of the locomotive superintendent and Mr. Percy Knight.

On the journey to Brighton attention was divided between the new cars which had to be traversed, the pleasing scenery—for the bad weather had been left behind in London—and practical experiment of the system by which passengers are to obtain refreshments furnished from the restaurant in car "Victoria." All the cars, by the way, are graced by Royal names. The parlour and restaurant car "Victoria" is considered the headquarters of the train. It has 28 seats, and a bar counter for the service of light refreshments. Here are the newspaper stand and letter-box, the barometer, thermometer, and clock, and the electrical discs and bell indicating to the steward or attendant in what part of the train he is wanted. Behind, or in front, according to the way the train is travelling, is the smoking room, called "Maud," which has 26 seats, and communicates with a servants' compartment, the luggage room, and the quarters of the guard. On the other side of the Victoria car is the drawing-room car "Beatrice," which contains also the ladies' boudoir and dressing room. Then beyond is the parlour car "Louise," with behind it another servants' compartment and luggage room. The interior of a Pullman car needs no description now-a-days, and it is enough to say that the artistically furnished and decorated cars of the new train have nothing to lose in a comparison with previous works of the same kind. On the return journey, which was made by the direct route, the great novelty was the demonstration of the lighting of a whole train by electricity. The feature had not been unnoticed on the way down when the tunnels were entered, but on the road home after dark the light was on its trial the whole way. There was not the shadow of a shade of doubt as to the success of the trial. The steady soft white light of the incandescent carbon threads in the little sealed glass lamps—these tiny horseshoes, burning but not consumed—were approved, admired, acclaimed. To read by them was a pleasure, and to write by them as nearly delightful as writing ever can be in a train. There were thirty lights in the train; none gave a less brilliant light than another; and any one light could be put out without the others being affected. The light came from thirty-four of Faure's accumulators in the guard's compartment. These magazines of electricity had been filled at the Strand, but they will hereafter be charged by an engine and dynamo machine at Victoria Station. There is under consideration a project for making the train store up electricity for itself by the working of a dynamo machine attached to the axle of the engine. It is also contemplated to attempt the application of electric lighting to ordinary trains. The train is fitted with the Westinghouse brake. We understand that the regular service of the Pullman limited express commences on Monday next; and that the train will run twice each way daily, excepting on Sundays, when one journey only in each direction will be made.

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LES LAMPES A INCANDESCENCE

Parmi les nombreuses applications de l'électricité à l'industrie, il en est une qui attire à Paris, dans le palais de l'Exposition d'électricité, l'attention générale. Elle arrive d'Amérique, où elle est en voie de réalisation dans la capitale des États-Unis, et, comme la nouvelle de sa découverte avait été critiquée par les savants français, il y a un an environ, la surprise qu'elle cause par son fonctionnement, n'en est que plus générale.

Nous voulons parler de l'éclairage électrique par les lampes à incandescence. Trois ou quatre inventeurs ont exposé des lampes, mais une seule réunit, par la simplicité de sa construction, par la canalisation à laquelle elle est reliée, les qualités indispensables à un usage constant, capable de se plier à toutes les exigences du régime industriel ou de la vie domestique.

C'est la lampe Edison. Pour plus d'exactitude, disons « le système Edison » dont la lampe n'est qu'une partie essentielle, il est vrai, mais une partie dont l'application serait impossible sans la canalisation à laquelle elle est reliée. Il est facile d'en acquérir les preuves dans les deux salons occupés par l'exposition Edison, et éclairés, le soir, par ses lustres, ses candélabres, ses chandeliers portatifs que les curieux éteignent ou allument à volonté, et ses branches pivotantes se tournant avec autant de facilité que les branches semblables à bougie ou à gaz.

Aussi, est-ce avec peine qu'on peut, dans ces salons, se frayer un passage à travers la foule qui, en même temps qu'elle se familiarise avec les lampes appelées prochainement à se substituer à tous les systèmes en usage, se repose de la fatigue des yeux, produite par les oscillations des foyers puissants de lumière blanche, éclairant la grande nef du palais et quelques salles des galeries.

La lampe à incandescence de M. Edison donne une lumière douce, jaunâtre, semblable à celle du gaz, mais d'une fixité complète. Elle se compose d'un globe de verre de la forme et de la grosseur d'une poire ordinaire, à l'intérieur duquel un filament de charbon, en forme d'n, est relié à deux fils de platine. Ce filament de charbon, de la grosseur d'un cheveu, est obtenu par la carbonisation d'une fibre de bambou. Le

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vide est fait dans le globe. Sa partie inférieure est close par un tampon de matière isolante, dans lequel sont scellés deux anneaux en cuivre rattachés chacun par une soudure, à un fil de l'intérieur. C'est par ces anneaux que s'établit le contact avec le circuit électrique extérieur envoyé par la machine dynamo-électrique Edison, à l'aide d'une canalisation dont nous allons donner la description.

Lorsque le contact est établi, la lumière jaillit autour du charbon porté à l'incandescence par le passage du circuit. La lumière est douce, fixe, et n'est nullement sujette aux oscillations des lampes à arc voltaïque, dans lesquelles l'écoulement électrique se faisant d'un pôle de charbon à l'autre, détermine une succession rapide d'étincelles, dont l'intensité peut être modifiée, non seulement par les inégalités de travail de la machine motrice, mais aussi par le mouvement des molécules de l'air, tantôt échauffées par les décharges électriques, tantôt remplacées par les molécules plus froides de l'atmosphère ambiante.

La lampe Edison, brûlant dans le vide, ne dégage ni odeur, ni fumée; quant à sa chaleur, elle est si faible, qu'on peut presser le globe de verre dans sa main sans éprouver aucune sensation brûlante.

La canalisation, qui permet au système Edison de transporter commodément l'électricité aux lampes se divise en trois parties : 1° la canalisation des rues ; 2° la canalisation des immeubles ; 3° la canalisation des appartements. Nous ne nous étendrons pas sur le générateur d'électricité Edison, dont les armatures et les aimants sont fort ingénieusement combinés, cependant, pour diminuer la résistance du circuit; cela nous mènerait trop loin. Disons seulement que la canalisation des rues est destinée à se rattacher à des usines de production d'électricité, dans lesquelles plusieurs milliers de chevaux-vapeur, doivent actionner des batteries de machines dynamo-électriques nécessaires à l'éclairage de toutes les habitations d'une ville.

La canalisation des rues se compose d'un tuyau en fer de cinq centimètres de diamètre contenant deux conducteurs en cuivre demi-rond de un centimètre de diamètre, isolés par une sorte de gutta-percha à bon marché qui remplit le tuyau. Les deux conducteurs sont rattachés aux deux piles de la batterie électrique, et le tuyau qui les contient est posé sous les pavés, à soixante centimètres environ du niveau du sol; on peut aussi le suspendre à la voûte des égouts. Les jonctions des canalisations de différentes rues, s'opèrent au moyen de boîtes dans lesquelles on réunit les conducteurs, à l'aide d'armatures disposées de telle sorte, qu'un éboulement, une rupture, un accident, se produisant dans une rue, ne déterminent aucune interruption du circuit dans les autres rues aboutissantes. Lorsque les jonctions sont opérées, les boîtes sont remplies de la même matière isolante que celle des tuyaux.

La canalisation des immeubles est identique à celle des rues, sauf

que les conducteurs et le tuyau ont un diamètre plus petit. Elle se relie à la canalisation principale dans des boîtes de jonction d'après le même principe d'indépendance des canalisations appliqué dans les grandes boîtes des carrefours. Elle se place sous les trottoirs, enveloppe les immeubles et se fixe après les murs principaux.

La canalisation des appartements se compose de deux fils de cuivre de $2^{m}/_{m}$ à $3^{m}/_{m}$ de diamètre, entourés d'une enveloppe de coton incombustible. Elle se fixe le long des cimaises, des plinthes ou des frises pour gagner, sur les murs ou les plafonds, les supports d'attache des lampes ou des lustres. Elle remplit absolument le rôle des petites conduites en fer ou en plomb dont on se sert pour le gaz. Sa jonction avec la canalisation de l'immeuble se fait dans des boîtes, toujours d'après le principe que nous avons expliqué pour les rues. M. Edison en a même réalisé l'application dans les patères de chaque lampe, si bien qu'une lampe peut se briser ou s'éteindre sans qu'aucun inconvénient en résulte pour la lampe voisine.

Lorsque le circuit est établi, on allume ou on éteint chaque lampe à l'aide d'un commutateur placé sur la branche qui la supporte.

Ce sont ces dispositions réalisées à l'aide de contacts ménagés habilement dans les patères d'attache aux murs, dans les pivots, etc., qui complètent le système Edison et lui permettent de se substituer avec avantage à l'éclairage au gaz, ou à l'huile, ou à tout autre système.

L'illustre inventeur a même neutralisé les dangers d'incendie résultant de l'emploi de la lumière électrique. On sait que les fils conducteurs, par suite d'une trop forte tension, peuvent s'échauffer à l'endroit où se produit la plus grande résistance, au point de rougir et de communiquer le feu aux objets voisins. Outre des régulateurs de courant, distribuant l'électricité au fur et à mesure des besoins de la consommation, M. Edison a interposé, dans le circuit électrique, des armatures de sûreté en plomb qui fondraient si la température venait à dépasser une certaine limite. Ces armatures de sûreté sont placées dans toutes les boîtes de jonction des rues et des appartements. Tout danger se trouve ainsi écarté.

Ajoutons que, chaque consommateur est pourvu d'un compteur enregistrant les quantités d'électricité consommée. A New-York, où des quartiers entiers sont déjà éclairés, la lumière, à pouvoir éclairant égal, est livrée au même prix que celle du gaz. A Paris, M. Batchelor, le collaborateur et l'ami de M. Edison, se livre à des expériences économiques au Palais de l'Industrie, à la suite desquelles il va organiser des usines pour la fabrication des machines électriques, des lampes, et de tout le matériel de canalisation.

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SYSTÈME D'ÉCLAIRAGE ÉLECTRIQUE EDISON

L'attention publique est vivement surexcitée par l'exposition du système d'éclairage Edison au Palais de l'Industrie. Nulle part, le problème de l'éclairage par l'incandescence n'est aussi complètement, aussi pratiquement résolu; il devient de plus en plus évident que la lampe Edison est appelée à se substituer prochainement aux autres systèmes d'éclairage au gaz ou aux huiles végétales ou minérales; il est donc intéressant d'examiner attentivement les détails de cette invention, dont l'application constitue le commencement d'une véritable révolution industrielle.

Le système d'éclairage Edison se compose de trois parties distinctes : 1° le générateur d'électricité; 2° la canalisation; 3° la lampe.

La place nous fait défaut pour nous livrer à une description détaillée du générateur d'électricité Edison. Disons cependant que la disposition des cylindres de l'armature est telle, que la liaison des barres de cuivre dont ils sont formés, avec les anneaux en cuivre adaptés aux extrémités de ces barres et isolés les uns des autres, a pour effet de constituer un seul et même circuit, enveloppant longitudinalement le cylindre. Ce circuit se trouve relié de deux en deux barres avec le collecteur. Les interversions magnétiques sont aussi rendues plus promptes par un cylindre de bois, occupant le centre du cylindre principal et garni de rondelles en fer isolées par des feuilles de papier. Ces dispositions, en réduisant à une faible proportion la résistance du générateur, permettent une grande division du courant par dérivation.

C'est en effet par dérivation que M. Edison construit ses canalisations. Au sortir de la machine dynamo-électrique, la dérivation du courant induit correspondant à un électro-dynamomètre, après avoir traversé une résistance de 180 000 ohms. L'appareil indique les variations de l'intensité électrique de régence qui, normalement, doit être de 110 volts. Une variation de 1 volt correspond à trois divisions de l'échelle indicatrice de l'appareil. Au moyen d'un commutateur à bobine de résistances différentes, M. Edison introduit dans le circuit, une résistance capable de compenser un accroissement d'intensité électrique, et il opère non sur les conducteurs des lampes, ce qui amènerait une perte de travail, mais sur le circuit des inducteurs de la machine.

La canalisation du système Edison se subdivise en trois parties : 1° la canalisation principale; 2° la canalisation des immeubles; 3° la canalisation des appartements, toutes trois établies successivement en dérivation, les unes sur les autres.

La canalisation des rues, rattachée aux deux pôles de la machine dynamo-électrique Edison est formée de deux barres de cuivre à surface semi-cylindrique d'un diamètre d'un centimètre et demi. Ces barres sont enfermées dans un cylindre de matière isolante, sorte de gutta-percha à bon marché, enveloppé lui-même par un tuyau en fer de sept centimètres environ. Cette conduite semblable à celle employée pour le gaz, mais d'un faible diamètre se place dans la terre à soixante centimètres environ du niveau du sol ou se suspend à la voûte des égouts, aussi aisément que les conduits télégraphiques. Sa bifurcation en deux, trois ou quatre directions, suivant le nombre des rues à desservir, s'opère dans des boîtes de jonction placées aux carrefours de ces rues. Les barres conductrices sont reliées les unes aux autres par des armatures en cuivre, fixées avec vis de jonction, d'un montage et d'un démontage facile. Grâce à ces dispositions, chaque branchement conserve une entière indépendance, à ce point qu'une rupture de l'un d'eux déterminée par un éboulement ou par toute autre cause, ne se fait nullement sentir sur les autres branchements. Ces boîtes ont une double enveloppe, l'une en fonte, l'autre en carton; lorsque les jonctions y sont opérées, on les remplit de matière isolante et on y boulonne un couvercle en fonte.

La canalisation des immeubles est identique à la canalisation principale, sauf qu'elle a un diamètre plus petit. On sait que l'entretien d'un courant dans un fil demande une dépense d'énergie proportionnelle au carré de l'intensité du courant et à la résistance du fil; on sait aussi qu'un circuit fermé peut être considéré comme un aimant dont le moment magnétique, est proportionnel à l'intensité du circuit et à la surface enfermée : il en résulte que la grosseur des conducteurs doit varier avec l'intensité du courant qu'ils sont appelés à véhiculer et c'est ce principe qui a guidé M. Edison dans la construction de ses canalisations.

Celle des immeubles est donc plus petite que celle des rues et de même forme. Leur jonction s'opère également dans des boîtes d'une grandeur convenable avec des armatures assurant la complète indépendance de la canalisation principale. Le tuyau devant desservir un immeuble se place sous les trottoirs, enveloppe les bâtiments à éclairer, gravit les murs principaux, et c'est sur lui que vient se greffer la canalisation des appartements.

En vertu du principe que nous venons d'émettre, cette canalisation est d'un plus faible diamètre que celle des rues. Elle se compose simplement de deux fils recouverts d'une enveloppe de coton incombustible.

Elle court le long des cimaises ou des plafonds, comme les fils des sonneries électriques, et c'est sur elle que viennent se rattacher les fils plus petits encore chargés d'alimenter les lampes.

La jonction de la canalisation des appartements avec celle de l'immeuble est faite dans de petites boîtes, toujours en conservant à chaque branchement son entière indépendance. M. Edison a même réalisé cette indépendance pour chaque lampe au moyen d'une disposition supérieure de fils dans leurs patères d'attache aux murs. Si bien qu'une lampe peut se briser ou s'éteindre sans aucune conséquence pour sa voisine.

Hâtons-nous de le dire, et c'est là, à notre sens, la puissante marque du génie du savant américain, que ces résultats sont obtenus par des moyens si simples, si pratiques, que le premier venu peut les mettre en œuvre. M. Edison a poussé le souci des exigences pratiques jusqu'à établir des contacts aux deux extrémités d'un noyau isolant qui lui sert de pivot pour les branches pivotantes de ses lampes, semblables à celles des genouillères à gaz. La rotation s'opère sur deux plateaux de cuivre qui permettent de prolonger les fils dans un nombre quelconque de parties droites rattachées les unes aux autres par ces noyaux.

Sa canalisation est en outre pourvue d'organes qui neutralisent les dangers d'incendie. On sait que, par suite d'une tension trop élevée, les fils conducteurs peuvent s'échauffer au point de rougir et communiquer le feu aux objets voisins. Ce fait s'est produit dans la salle de lecture du Palais de l'Industrie éclairée par une lampe d'un autre système. Les fils ayant à supporter une trop forte tension se sont échauffés et la cloison a pris feu.

Pour éviter ce danger, M. Edison a interposé dans le circuit, des armatures en plomb qui fondraient si la température venait à s'élever, de sorte que le circuit serait immédiatement interrompu. Comme le phénomène a son maximum d'intensité au point où la résistance du circuit est la plus grande, M. Edison a placé ces armatures de sûreté dans toutes les boîtes de jonction des canalisations et dans les patères d'attache de chaque lampe. On conçoit que cette précaution jointe à la manœuvre de l'électro-dynamomètre, dont nous avons parlé tout à l'heure, rendent tout accident impossible.

Il nous reste maintenant à parler de la lampe Edison.

La lumière, dans la lampe Edison, est produite par l'incandescence dans le vide d'un conducteur reliant les deux fils du circuit. La difficulté était de trouver un conducteur assez résistant pour ne pas se briser au passage du courant et assez mince pour l'étrangler suffisamment et devenir incandescent. M. Edison après avoir essayé le platine, différents papiers et des matières soyeuses, s'est arrêté au filament de charbon obtenu par la carbonisation d'une fibre de bambou. Ce filament prend la forme d'un ∩ dans un globe de verre de la grosseur d'une poire

moyenne. Ses extrémités sont reliées à deux fils de platine; ceux-ci sont soudés à deux anneaux en cuivre scellés dans un tampon de plâtre qui ferme la partie inférieure du globe. C'est par ces anneaux que le contact s'établit avec le circuit extérieur. L'un d'eux étant muni d'un pas de vis, se pose sur tous les genres de support où un pas de vis semblable aura été ménagé. C'est ainsi que, dans l'exposition de M. Edison, ses lampes brillent sur des lustres de quatre-vingts branches aussi bien que sur des genouillères de bureau et d'atelier, des appliques d'appartements ou des chandeliers portatifs propres à tous les usages.

La lumière d'une lampe Edison a l'intensité et la couleur de celle d'un bec de gaz avec cette différence qu'elle ne modifie pas les couleurs et qu'elle ne fatigue pas la vue. Comme elle brille dans un globe fermé, elle ne dégage ni odeur, ni fumée et si peu de chaleur qu'on peut presser le globe de verre dans sa main sans en être incommodé. Le vide est obtenu dans le globe, quand le filament de charbon y est placé avec les fils de platine soudés aux deux anneaux du tampon extérieur en plâtre. Une tubulure de verre se prolonge à la partie supérieure du globe, qu'on met en communication avec les aspirateurs des pompes pneumatiques. Quand le vide est opéré, on fond la tubulure avec un jet de lampe à émailleur et le tube se ferme en fondant. M. Edison s'est servi autrefois de pompes à mercure Springel et Gessler, mais les émanations mercurielles qui s'en échappaient, compromettant la santé des ouvriers, il a simplifié la construction de ces pompes. Cinq cents pompes de ce système fonctionnent aujourd'hui à Menlo-Park sans manipulation dangereuse. Le vide obtenu est tel qu'un fil de charbon, qui donnerait une intensité de lumière de 10 bougies, dans le vide d'une machine ordinaire, arrive à produire dans le vide fait à l'aide d'une pompe perfectionnée, une intensité de 16 bougies.

C'est grâce à un vide aussi parfait que la lampe Edison peut durer de six à huit mois, car, s'il en était autrement, l'oxygène de l'air activerait la combustion du charbon et la lampe n'aurait que peu de durée.

Le système d'éclairage de M. Edison est complété par un régulateur d'intensité de courant, permettant d'affaiblir la lumière à volonté. Ce rhéostat est formé de charbon de différentes sections, et suivant qu'on fait passer le courant à travers l'un d'eux, on obtient l'intensité que l'on désire. Cet appareil s'applique aussi bien à une seule lampe qu'à un ensemble de lampes. Chacune d'elles est du reste munie d'un commutateur en forme de robinet au moyen duquel on établit ou on interrompt le circuit. Le commutateur a pour effet, lorsqu'on éteint la lampe, de faire passer le circuit à travers une dérivation de faible résistance pour le renvoyer sur le circuit principal, de sorte qu'aucune détérioration de l'appareil ne peut résulter de l'étincelle de rupture.

Le système Edison, étudié, raisonné dans la moindre de ses parties,

prend un caractère industriel que n'a encore revêtu aucun autre système. D'autres lampes ont été construites, mais aucune n'était pourvue d'organes aussi bien appropriés à un usage général. C'est à l'illustre solitaire de Menlo-Park que revient la gloire de réaliser aujourd'hui une révolution semblable à celle qui s'est produite quand le gaz s'est substitué aux chandelles et aux lampes. Seulement le domaine du gaz était circonscrit, tandis que celui de la lumière Edison, qui va se substituer à lui, est-il limité.

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LA LUMIÈRE ÉLECTRIQUE ET LA LUMIÈRE DU GAZ

On a déjà fait remarquer que l'Exposition d'électricité met en évidence la substitution prochaine de la lumière électrique à celle du gaz. Jusqu'à l'exposition, on pouvait concevoir des doutes sur la réalisation d'une pareille supposition. La lumière électrique ne se prêtait qu'à l'éclairage des grandes surfaces; on l'appliquait dans nos rues, sur nos avenues, dans quelques grandes industries, mais ses imperfections rendaient beaucoup de personnes hésitantes; chacun sentait que le dernier mot, en matière d'éclairage électrique, était loin d'être dit, même avec les brûleurs les mieux perfectionnés. Aussi le nouveau mode d'éclairage ne marchait-il qu'à pas très lents. A des intervalles éloignés, quelques globes faisaient l'ornement d'une façade d'hôtel, d'un boulevard nouvellement percé, d'une fête publique, mais ce n'était là qu'un usage passager, qu'on s'offrait comme un luxe. La lumière électrique n'était pas pourvue d'organes la rendant véritablement supérieure, tant sous le rapport de l'économie que de la commodité, à tous les autres systèmes d'éclairage. Elle ne pouvait prétendre encore à se substituer complètement à eux; si quelques ateliers de grande industrie pourvue d'une force motrice suffisante installaient quelques foyers à arc voltaïque, les industries où le travail est divisé, où l'organisation des ateliers, des chantiers, nécessite le morcellement de l'usine, restaient éclairés à la lumière du gaz. A plus forte raison, la lumière électrique ne pouvait-elle pénétrer dans nos appartements où nous restions voués à nos lampes fumeuses à l'huile, au pétrole, à l'essence, ou à nos bougies ou nos chandelles primitives.

M. Edison en résolvant le problème de la division de l'électricité, en rendant cette division plus simple, plus pratique que celle du gaz, en créant une lampe à incandescence d'une clarté douce et fixe, ne dégageant ni odeur, ni fumée, puisqu'elle brille dans un globe fermé, et qu'elle produit une chaleur insignifiante, vient tout remettre en question. Les inconvénients, les dangers des autres systèmes se présentent à l'esprit; des rapprochements, des comparaisons s'établissent, d'où naît la certitude de bientôt voir la lumière Édison se propager dans tous les milieux et créer dans nos habitudes, une révolution plus complète encore

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que celle causée par le gaz, lorsqu'il s'est substitué aux procédés en usage avant lui.

On pourrait écrire un gros volume sur les inconvénients et les dangers du gaz. La liste de son martyrologe est déjà longue et nous aurions fort à faire s'il nous fallait relever le nombre des victimes ayant trouvé la mort ou reçu des blessures dans les explosions, les incendies, les asphyxies qu'il a déterminées : que serait-ce encore, s'il nous était permis d'examiner plus profondément les conséquences de son emploi dans nos ateliers; non pas ceux nouvellement construits en rase campagne avec de larges fenêtres et une hauteur de plafond convenable, mais dans ceux de l'intérieur de Paris, où le terrain coûtant cher est disputé pied à pied ; où les machines, les outils sont entassés les uns sur les autres ; où les plafonds sont bas; où le jour est si rare qu'on est obligé de tenir le gaz allumé du matin au soir.

Il y a là des milliers d'ouvriers et d'ouvrières, qui s'étiolent à respirer un air vicié par les émanations carboniques du gaz. Non seulement l'air y est rare, concentré, dans un état permanent de moiteur, mais le gaz y brûle presque constamment, achevant de consumer le minimum d'oxygène qui s'y trouve, pour alimenter la respiration des personnes qui y travaillent. Et l'on s'étonne, en voyant sortir chaque soir de ces ateliers, une armée d'ouvriers et d'ouvrières, que beaucoup ont les paupières rougies, la figure maigre et pâle, la poitrine à peine développée, les membres grêles. Il n'en peut être autrement cependant avec les conditions hygiéniques qui leur sont imposées et que l'usage du gaz achève de pervertir quand il ne les rend pas tout à fait mortelles.

S'il était possible de suivre les progrès de cet empoisonnement lent dans les groupes ouvriers, que de victimes n'y compterait-on pas, quand l'âge arrive et que les artères et les veines n'ont à véhiculer qu'un sang brûlé ou appauvri.

Le gaz entre pour une large part dans ces résultats, qui seront bien vite modifiés, lorsque la lumière électrique lui aura été substituée. Ces inconvénients du gaz sont si évidents que, dans les ateliers du centre de Paris où des journaux s'impriment pendant la nuit, tous les passants peuvent remarquer qu'en hiver comme en été, les portes et les fenêtres des ateliers de typographie restent ouvertes. Les typographes composent devant un bec allumé, la plupart, tellement incommodés par la chaleur, qu'ils travaillent avec leur blouse et leur chemise dégrafées. Au bout d'une heure ou deux ils sont obligés de quitter l'atelier pour se désaltérer. C'est ainsi qu'on les rencontre, en hiver, la tête et le cou nus, suant et courant aux abords du faubourg et de la rue Montmartre. C'est là un régime seulement favorable aux pleurésies ou aux fluxions de poitrine.

Comme les typographes jouissent d'une certaine liberté et remédient

de cette façon aux inconvénients de la chaleur du gaz, que faut-il penser des ouvriers et des ouvrières employés à ces mille travaux de l'industrie parisienne, exigeant autant d'attention que d'habileté. Les nécessités du travail les retiennent devant leur table, à leur étau, à leur tour, sous les feux du gaz. Et les plus favorisés, ceux dont les ateliers donnent sur une cour assez éclairée, sont condamnés à respirer des émanations carboniques au moins trois ou quatre heures par jour.

La lumière électrique, dont les découvertes de M. Edison ont rendu l'application possible, va donc améliorer profondément l'hygiène de ces milieux en même temps qu'elle facilitera le travail des ouvriers, puisqu'elle ne modifie nullement les couleurs.

Où elle sera accueillie aussi avec empressement, c'est dans les établissements publics : théâtres, cafés, cercles, restaurants, partout où le gaz, outre ses inconvénients hygiéniques, est un élément permanent de destruction. On sait avec quel luxe toutes les salles publiques sont décorées. Elles luttent de richesse, d'élégance, pour rendre leur séjour plus agréable. Nos artistes peintres, sculpteurs et ornemanistes, mettent leur imagination à l'œuvre pour recouvrir les panneaux, les frises, les plafonds d'un monde fantastique et gracieux, y enlaçant des chimères, des feuillages, des allégories, y faisant rire des femmes dans des forêts d'acanthes, ou bondir des chevaux au milieu des nuées. Quand ils ont emporté leur échelle, celle du poseur d'appareils à gaz prend la place et bientôt les lustres y suspendent leurs élégantes nervures dans les scintillements des cristaux ; les suspensions, les appliques y déroulent leurs courbes ; les globes dépolis y prennent leur vague ressemblance d'énormes perles fausses. L'œil est satisfait; ces appareils complètent l'harmonie du décor de la salle; ils la meublent, ils la peuplent. La voilà, selon le cas, d'une richesse coquette, pimpante ou sévère. Quelque temps après, quand les flammes du gaz ont accompli leur œuvre destructrice, les plafonds sont noircis; chaque bec a marqué sa place sur les dorures, les blancs sont devenus jaunes ; les peintures à l'huile ont peu à peu disparu et il arrive, comme à l'Opéra, que des chefs-d'œuvre se sont évanouis en fumée. Dans ce dernier cas, le malheur est irréparable. Dans les autres cas, c'sst en renouvelant souvent les mêmes dépenses de réparation, qu'on peut entretenir l'immeuble en bon état. Nous ne voulons pas parler ici des ennuis imposés aux personnes qui fréquentent les établissements publics éclairés au gaz, on pourrait nous accuser de sybaritisme. Disons seulement que pendant l'été, il les rend inabordables, et pendant l'hiver, souvent inhabitables.

Cette série d'inconvénients est encore appelée à disparaître par l'application générale du système d'éclairage Edison. C'est aussi au savant Américain que nous devrons de voir les dangers d'explosion supprimés. S'il se produit des fuites d'électricité, elles ont ceci de bon qu'elles ne

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dégagent aucune mauvaise odeur et qu'on peut en approcher une chandelle, sans crainte de voir la conduite vous sauter au visage.

Quant à nos appartements particuliers, dans lesquels le gaz n'a pu encore pénétrer à cause de ses imperfections, l'application de la lumière Edison y est à l'avance résolue. L'huile, la soléine, le pétrole, la bougie, toutes les huiles et toutes les essences ont été trop souvent accablés de malédictions, pour que nous prenions la peine d'énumérer leurs inconvénients.

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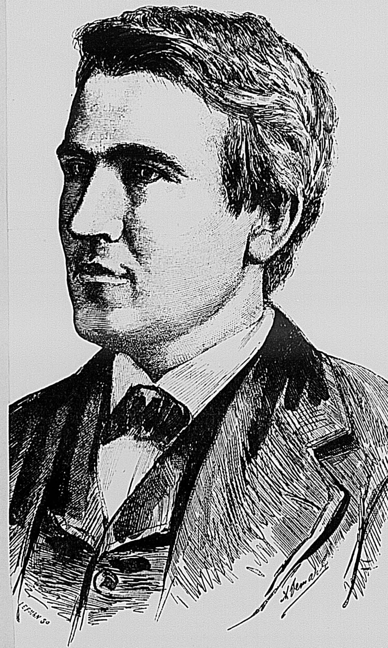

THOMAS-ALVA EDISON

THOMAS-ALVA EDISON

SA VIE

I

Quel est donc cet homme dont le nom absolument ignoré hier, déjà célèbre aujourd'hui, aura bientôt sans doute une illustration et une popularité universelles ? D'où procède ce prince de la science devant lequel chacun s'incline avec respect, et qui, du haut de son installation splendide, semble dominer en autocrate dans ce Palais des Champs-Elysées où le monde physico-chimique a envoyé ses chercheurs les plus intrépides et les plus distingués ? Voilà des questions, posées bien des fois, que la curiosité avide des visiteurs de l'Exposition internationale d'électricité va renouveler avec une insistance croissante à mesure que l'on aura mieux compris l'importance actuelle et les conséquences certaines des conquêtes réalisées dès à présent par le « César de l'invention », comme l'ont surnommé ses compatriotes.

Eh bien, ce potentat de l'industrie, dont les usines et les établissements multiples, pourvus d'un matériel immense et répandus partout en Amérique et en Europe, représentent une fortune énorme ; cet archi-millionnaire, en mesure, quand il le voudra, de disputer la palme des richesses à l'*hombre d'oro* lui-même ; ce nabab américain doit le jour à un humble travailleur qui, n'ayant pas de pain à lui donner, invitait son fils, âgé de douze ans à peine, à aller en chercher hors du logis paternel.

Ce savant prodigieux dont les découvertes déconcertent les spécialistes les plus érudits, et dont chaque invention, reçue d'abord comme une de ces mystifications gigantesques que les Yankees se plaisent à lancer de temps en temps sur le vieux monde, devient bientôt l'objet d'une admiration mêlée d'une sorte de stupeur ; ce maître glorieux entre tous, que l'histoire prendra peut-être pour un des parrains du dix-neuvième siècle ; cet oracle incontesté et suivi n'a jamais été à l'école.

Il a reçu de sa mère, femme intelligente et assez instruite, quelques notions rudimentaires de lecture, d'écriture et de calcul, et c'est là tout ce qu'il a appris des autres. Le reste, ce serait le cas de dire avec Rossini : « excusez du peu », il le doit à lui seul, à l'unique puissance de son génie. Sans maître aucun, sans direction ni conseils ; au mépris de toute méthode, de tout plan, de toute règle ; au hasard, pour ainsi dire, et au seul gré de son imagination insatiable de connaissances quelconques, cet indiscipliné sublime s'est élancé à l'assaut de la science, et il en a gravi victorieusement les sommets les plus élevés par des routes où nul n'avait passé avant lui.

Cette similitude entre les commencements d'Edison et les débuts dans la vie de la plupart des hommes qui, dans les sciences, les arts, l'industrie — ajouterons-nous la littérature — ont brillé d'un éclat extraordinaire, provoque de curieuses réflexions et mériterait l'attention des hauts personnages chargés de préparer les programmes pédagogiques des *séminaires* démocratiques de l'avenir. Comme le remarque un des biographes à qui nous empruntons les éléments de cette notice, « les inventeurs ne sortent généralement pas des classes riches et élevées ». Mais ils ne sortent guère davantage des écoles supérieures officielles, et l'un des plus profonds penseurs de notre temps constatait naguère, entr'autres observations intéressantes sur les résultats de l'instruction donnée par l'Etat, que tous les grands travaux publics exécutés en Europe dans le courant du siècle étaient dus à des ingénieurs privés de diplôme et de toute attache gouvernementale. N'insistons pas sur cette matière assez délicate, et revenons à notre héros dont nous allons parcourir à longues enjambées la carrière singulièrement laborieuse et accidentée.

Thomas-Alva Edison, dont l'enfance s'est écoulée dans la triste ville de Port-Huron dans le Michigan, est né à Milan, comté d'Erié, Etat de l'Ohio, le 10 février 1847. Son père, d'origine hollandaise, et qui — heureux présage ! — ferme et sain lui-même comme un roc à soixante seize ans passés, compte dans sa famille deux centenaires encore bien portants, avait été tour à tour tailleur, pépiniériste, grainetier, brocanteur, marchand de biens ; mais, malgré son intelligence et son énergie, il n'avait pas réussi à amasser, dans l'exercice de ces professions diverses, l'aisance nécessaire pour procurer à son fils une instruction un peu sérieuse. Edison dut donc se contenter des leçons de sa mère qui, à l'exemple de beaucoup de jeunes Américaines, avait avant son mariage dirigé une école primaire. D'un caractère concentré et même un peu sauvage ; recherchant la solitude où il pouvait s'adonner à l'aise à sa passion effrénée pour la lecture ; dévorant avec une égale avidité et sans préférence tout ce qui lui tombait sous la main, livres, journaux, brochures, revues, et prêtant à tout un vif intérêt, le jeune Edison atteignit sa douzième année sans que le moindre indice eût révélé à son entourage les qualités exceptionnelles, les aptitudes multiples dont la nature avait doté le futur inventeur du téléphone et de l'électromotographe.

Cependant, l'entretien d'une *bouche inutile*, dans cette humble demeure de Port-Huron assiégée par une misère persistante, devenait onéreux. Aussi, jugeant que son fils, auquel il avait transmis, avec son énergie et son activité d'esprit, une constitution excellente et un tempérament robuste, avait atteint un développement physique et moral suffisant, l'ex-tailleur-grainetier-pépiniériste prit-il la résolution de l'abandonner à ses propres forces. Un soir, en soupant, il lui annonce donc que, dès le lendemain, il travaillerait en qualité de *train-boy* sur la grande ligne du Canada et du Central-Michigan, que désormais il devait se suffire à lui-même et ne plus compter sur l'assistance des siens ; et après avoir déboursé les *frais de premier établissement* de l'apprenti commerçant, il crut en conscience s'être acquitté complètement des obligations légitimes de sa paternité. En véritable nourrisson de cette terre bénie du self-government et de l'initiative individuelle, le jeune Edison reçut sans observation, avec calme, sinon avec joie la déclaration paternelle, et le jour suivant, il faisait son entrée dans le monde : *to begin in the world*.

Ici se termine la phase tranquille, insouciante, *oisive* de la carrière d'Edison. C'est comme le prologue de ce roman d'aventures qui commence dans un fourgon de railway pour finir comme une féerie dans une apothéose.

Le voilà donc parcourant son train d'un bout à l'autre pour offrir aux voyageurs des journaux, des magazines ilustrés, des gâteaux, des fruits, des cigares, du tabac, des pipes et des « allumettes chimiques ». Car c'est en cela que consiste la profession choisie pour son rejeton par la prévoyance de l'expérimenté hollando-américain.

Au bout de quelques jours, intelligent comme il l'était, Edison connaissait à fond toutes les ressources et les ficelles du métier, et dès qu'il eut réalisé quelques bénéfices, il prit à son service plusieurs enfants de son âge en leur confiant le soin de débiter à sa place ses marchandises. Cette combinaison permit au jeune *exploiteur* de satisfaire sa passion d'apprendre, toujours plus vive, et tandis que ses employés sollicitaient la clientèle, lui, paisiblement assis dans le fourgon des bagages, lisait les livres achetés du fruit de ses économies. Le « Traité d'analyse qualitative » de Frezenius, dans lequel il s'absorba sans se laisser décourager par les difficultés qu'il éprouvait à le comprendre, lui inspira la tentation de faire lui-même quelques expériences sur des substances dont le savant chimiste ne s'était pas occupé. Et, avec la puissance de volonté qui distingue les inventeurs et qui caractérise particulièrement Edison, il trouve le moyen d'installer dans son fourgeon tout un laboratoire où il commence sans guide le premier apprentissage de cette science dans laquelle il est promptement passé maître.

Tout d'ailleurs était pour lui sujet à réflexion. Les machines, les appareils dont il pouvait approcher excitaient son ardente curiosité et, pour s'expliquer les secrets de leur mécanisme et le mode de leur fonctionnement, il se met à étudier la physique et la mécanique, et toujours, bien entendu, par les mêmes procédés.

Les bureaux télégraphiques où il finissait par obtenir des employés les renseignements les plus minutieux ; les imprimeries où il s'introduisait furtivement en allant s'approvisionner des journaux, principal objet de son commerce, lui offraient des attractions irrésistibles, et il n'eut de repos qu'après avoir pénétré les doubles mystères de la télégraphie et de la typographie.

Mais Edison n'est pas un rêveur, c'est avant tout un homme pratique. Ainsi, se trouvant dans les ateliers du *Detroit Free Press* au moment où l'on vendait au rebut de vieux caractères, l'idée lui vient aussitôt de fonder un journal. Il achète donc les têtes de clou en question, se procure ailleurs les ustensiles indispensables, transporte le tout dans son fourgon, et quelques jours plus tard publie le *Grand Trunk Herald* dont il est à la fois rédacteur, prote, correcteur, tireur, plieur et qu'il livre tout frais aux voyageurs du train. Malheureusement, un flacon de phosphore qui servait à ses expériences de chimie, en tombant de la tablette où il était déposé, incendia le plancher du fourgon. Le conducteur du train aperçut à temps la fumée et éteignit le feu ; mais, pour éviter le retour d'un semblable accident, il jeta sur la voie le matériel complet du chimiste-imprimeur, après quoi il lui administra une rude correction.

Ce n'est, du reste, pas la seule mésaventure de sa vie de journaliste. A Port-Huron, où était toujours son domicile, il avait, encouragé par le succès de sa première feuille, créé un journal, le *Paul Pry* (Paul l'indiscret). Tous les collaborateurs qui se présentaient étaient bien accueillis à condition de ne réclamer aucune rétribution. Les articles n'étant pas signés, le *Paul Pry* ne gardait aucune réserve, attaquant gens, choses, institutions un peu à tort à travers. Un habitant de la ville violemment attaqué se chargea de venger toutes les victimes des indiscrétions du journal. Il rencontre Edison sur le quai, le prend par la cravate et la ceinture, et sans explication le jette à l'eau. Edison, qui savait nager, se sauva, mais le *Paul Pry* cessa de voir le jour.

Cette double leçon ne fut pas perdue. Edison résolut, en effet, de renoncer provisoirement à ses expériences et de consacrer tous ses loisirs à l'étude. Le train, dans lequel il exerçait son commerce, faisait régulièrement un arrêt de plusieurs heures dans la ville de Detroit. Aussitôt arrivé, notre *train boy* courait à la bibliothèque dont il s'était donné pour tâche de lire tous les volumes. Pour ne rien oublier, il commence par un bout avec l'intention de suivre les rayons méthodiquement et jusqu'au dernier tome. Il eut persévéré sans doute dans cette tentative insensée, et qui eut brisé une organisation moins privilégiée, si le bibliothécaire, pris d'intérêt pour un tel travailleur, ne lui eût expliqué la nécessité d'un choix et d'un ordre déterminés dans la lecture des ouvrages de science. Edison ne pouvait rester un seul instant oisif. A Port-Huron il n'avait pas de bibliothèque à sa disposition. Pour occuper utilement son temps lorsqu'il était de retour chez lui après chaque voyage, il cher-

cha à utiliser ce qu'il avait appris dans les bureaux télégraphiques de sa ligne. Il se procure des fils qu'il entoure autour de la maison de son père, organise des piles avec des pots hors d'usage et des débris de métaux et construit lui-même les appareils de transmission et de réception. A dater de ce jour, l'étude de la télégraphie n'a cessé d'etre sa plus chère préoccupation.

Par malheur, il ne pouvait consacrer à ses expériences sur l'électricité que ses heures de repos à Port-Huron, car il continuait son industrie ambulante. La maison de son père était à vingt minutes de marche de la station. Pour gagner ces vingt minutes, Edison dispose sur le bord de la voie, en face de la maison, un gros tas de sable, et, au passage, s'élance hardiment, le train marchant à toute vitesse. Cette manière de rentrer chez soi adoptée par Edison est fort originale et avantageuse, mais n'est pas à la portée de tout le monde. Nous nous arrêtons sur ces détails parce qu'ils permettent d'apprécier le courage, le sang-froid, l'agilité de l'homme vraiment extraordinaire dont nous esquissons la biographie. Voici un fait qui est une attestation éloquente du dévouement et de l'intrépidité d'Edison et dont la divulgation lui vaudra bien des sympathies. Il attendait un jour sur le quai de la gare de Port-Clement, lorsqu'il aperçoit près de lui, à vingt mètres d'une locomotive arrivant à toute vapeur, un tout petit enfant jouant sur la voie. Sans réflexion, d'instinct, Edison bondit d'un élan de tigre à travers la voie, enlève le baby au vol et retombe avec sa proie de l'autre côté des rails, affleuré par les tampons de la machine. Le père de l'enfant était le chef de gare de Port-Clement, et pour s'acquitter envers son sauveteur, il lui apprit la télégraphie d'une façon méthodique en lui donnant ainsi les moyens d'exercer une véritable profession. C'est alors qu'il renonça définitivement à son commerce de *train boy*, qu'il avait quitté à plusieurs reprises pour essayer divers métiers, celui de cordonnier notamment, et auquel il revenait après chaque tentative infructueuse.

Son apprentissage, on le devine, ne fut pas long. En fort peu de temps il devint un manipulateur habile et d'une extrême ingéniosité. Mais si, sous le rapport de l'intelligence et de la capacité, c'était un praticien modèle, c'était en revanche le plus détestable employé que l'on eût jamais rencontré. Il était toujours occupé d'une chose étrangère à sa besogne, oubliant de surveiller son appareil et laissant en souffrance les dépêches publiques et privées. A Stratford, dans le Canada, son directeur, qui connaissait ses distractions, lui impose, un soir qu'il le laisse de garde, l'obligation de télégraphier toutes les demi-heures le même mot à la station voisine. Edison, qui a rêvé un autre emploi de sa nuit, improvise un petit appareil que la grande aiguille de l'horloge mettait en mouvement et qui télégraphiait à sa place, le moment venu. Cette nuit-là, aucune dépêche ne fut enregistrée à son bureau, au grand étonnement de son correspondant, qui n'obtenait que le même mot revenant à intervalles fixes. Là, comme à Cincinnati, comme à Louisville, le trop ingénieux employé fut invité à chercher fortune ailleurs. C'est à Memphis, en 1864, qu'il eut la première idée de faire passer simultanément deux dépêches en sens inverse par le même fil. Cette proposition fut accueillie comme l'émanation d'un cerveau dérangé, et on refusa de l'expérimenter. Et ce ne sont pas deux dépêches, c'est quatre qu'il a réussi à faire ainsi se croiser sur le même fil!

A New-York enfin la chance le favorise. La *Gold and Stock Company* l'appelle pour réparer un indicateur qui s'était dérangé au moment où l'on en avait le plus grand besoin, et non seulement il le remet promptement en état, mais il y joint un appareil de son invention qui imprime successivement et sans perte de temps les variations des valeurs. Dès lors, son succès va croissant. La compagnie de l'Union des télégraphes de l'Ouest lui donne une magnifique rémunération pour avoir le droit d'exploiter sa première invention télégraphique, et, rassuré enfin sur l'avenir, il redouble d'efforts. Sa puissance de travail et sa fécondité d'esprit sont attestées par les nombreux brevets qu'il a pris et qui sont au nombre de trente-cinq pour les seuls perfectionnements apportés par lui au système Morse.

L'ex *train-boy*, riche et indépendant dans la pleine fleur de sa jeunesse, fait de la fortune l'esclave de sa science et de son génie. L'argent qu'il gagne lui sert à préparer des inventions nouvelles, et il continue à mener la vie d'un modeste employé. Pour pénétrer un secret de la nature, il n'hésitera pas devant une dépense à effrayer un gouvernement, et il a sacrifié ainsi plus de deux millions déjà, ce qui n'étonne pas ceux qui ont visité le splendide et incomparable laboratoire de Menlo-Park.

Comme tous les grands penseurs, Edison avait mené une vie très chaste. Il n'avait jamais songé au mariage, lorsqu'à Newark, où il avait établi une fabrique, il remarqua, un jour, malgré sa distraction habituelle, la douce et charmante physionomie d'une de ses ouvrières, Marie Stillwell. Le souvenir de cette vision venant souvent le hanter au milieu de ses expériences et de ses calculs les plus ardus, il commença à être pris d'inquiétude. Mais dès qu'il eut reconnu le sentiment par lequel il était dominé, son parti fut aussitôt pris. Il propose à la jeune fille de l'épouser sans plus de phrases ni de compliments, ni de déclarations, et, après l'avoir prévenue qu'il viendrait dans huit jours chercher une réponse, il courut se remettre au travail avec une nouvelle ardeur. Le mariage eut lieu peu de temps après. A l'issue de la cérémonie, Edison conduisit sa femme dans la petite maison dont elle devenait la maîtresse. Puis, lui ayant tout montré, il lui demanda la permission de la quitter pour aller surveiller dans son laboratoire une expérience importante, promettant d'être promptement de retour. Ceci se passait dans la matinée. A minuit, Edison n'était pas encore rentré au logis conjugal. Il était dans son laboratoire, où il serait resté on ne sait combien de temps, si l'un des témoins de son mariage, revenant du théâtre et voyant les fenêtres du laboratoire éclairées, n'eût été lui rappeler qu'il avait contracté le matin des engagements qui le réclamaient en un autre lieu. Ce trait, d'une exactitude absolue, achève de peindre l'inventeur dont nous venons de suivre la glorieuse carrière. Quant à l'homme, deux mots suffiront à le faire connaitre : c'est le plus tendre des pères et le modèle des maris. Le dimanche tout entier est consacré à ses deux enfants dont il partage les jeux avec un entrain d'une franchise pleine d'expansion et en faveur desquels il s'interdit toute conversation scientifique avec les visiteurs qui se présentent ce jour-là à Menlo-Park, dans le voisinage de New-York. Voici maintenant le portrait que trace de lui un de ses biographes:

« Sa physionomie, sérieuse et presque sévère lorsqu'il travaille, redevient jeune et gaie quand il cause avec des amis ou même avec de simples visiteurs. La préoccupation constante, la réflexion ont creusé sur son front une ride profonde qui s'accentue dans le travail, sans disparaitre jamais entièrement.

« Il a la figure complètement rasée. Ses cheveux noirs, où l'on commence à compter quelques fils d'argent, retombent sur son front en masses indisciplinées. Son regard tout interne et comme mort, lorsqu'il médite ou suit une expérience intéressante, est vif et bienveillant dans les actes de la vie ordinaire. Son sourire est franc et sa physionomie sympathique.

« Il est sobre, laborieux, d'une moralité et d'un désintéressement exemplaires. Il n'estime l'argent que pour les facilités de travail qu'il en retire; et lorsque quelqu'un s'émerveille devant lui en supputant la splendide fortune que son génie lui promet, il sourit en haussant les épaules avec dédain.

« Il ne travaille ni pour l'argent ni pour la gloire. Il est profondément indifférent à ce qu'on peut dire de lui. Son seul bonheur, sa seule ambition, son but dans la vie, c'est de découvrir, d'inventer, d'élargir de plus en plus le cercle des connaissances humaines, de surprendre un à un les secrets de la nature, de faire jaillir la lumière des ténèbres.

« Il marche, confiant dans sa force, sans se préoccuper de ce que les autres ont dit avant lui. Il n'accepte que ce qui lui est scientifiquement démontré, et, pour lui, l'affirmation du plus grand génie n'a que la valeur d'une hypothèse. Lorque la démonstration ne lui parait pas suffisante, il envisage à son tour la question. C'est ainsi qu'il en est arrivé à rejeter une partie de la théorie de Newton sur la gravitation. Il prétend que la matière n'est pas attirée, que le mouvement est une de ses propriétés et qu'elle va dans la direction où elle rencontre le moins de résistance.

« Personne plus que lui n'a horreur des idées préconçues, des opinions faites d'avance. Il a une façon originale d'envisager les choses qui rend sa conversation extrêmement intéressante. L'un de ses axiomes favoris est celui-ci : « Toutes les substances ont une intelligence proportionnée à leurs besoins. Expliquez-moi sans cela, dit-il, comment il peut se faire que le bourgeon d'une pomme de terre placée dans une cave obscure, fasse un trajet de cinquante mètres et s'élève, contrairement aux lois de la gravitation, pour atteindre un rayon de lumière? »

« Il a conservé le goût qu'il avait, étant jeune, pour la lecture, mais il choisit maintenant ses auteurs, et dit souvent qu'il vaut mieux lire douze fois un bon livre que lire douze ouvrages médiocres.

« En littérature, il aime les poètes d'imagination, les romantiques ; il lui faut une action dramatique et un style imagé. Il est admirateur passionné de Shakespeare et de Bulwer.

« En revanche, les auteurs qui se consacrent à l'étude patiente et approfondie du cœur humain lui plaisent moins. Tout en rendant justice à leur talent, il a peu de goût pour Thakeray, Dickens, George Sand et Balzac.

« L'âme humaine l'intéresse peu ; toutes ses forces intellectuelles sont concentrées sur l'observation des lois de la nature.

« On s'imaginerait facilement qu'Edison est inabordable. Si jamais homme eut de sérieuses raisons de se soustraire à la curiosité banale des importuns et de défendre sa porte, c'est bien celui-là. C'est un des motifs qui l'ont déterminé è s'établir à Menlo-Park, dans un petit village, loin de tout grand centre de population. Son espérance a été déçue.

« Les curieux viennent en excursion à Menlo-Park comme les dévotes en France vont à Lourdes. Chaque jour des troupes de visiteurs frappent à sa porte qui s'ouvre libéralement pour tout le monde.

« Edison accueille tout le monde avec cordialité. Il fait de bonne grâce les honneurs de sa personne et de ses inventions, il n'a rien de caché pour personne. Sur le premier moment, lorsqu'on l'arrache à ses travaux, il a la figure étonnée et distraite d'un somnambule qu'on vient d'éveiller brusquement; mais au bout d'un moment, sa physionomie s'éclaircit, il redevient jeune; on dirait un écolier en congé. Il cause gaiement avec les importuns, leur montre complaisamment ses principales inventions et leur expose souvent ses projets pour l'avenir. C'est alors que sa conversation devient d'un intérêt extrême et que sa parole prend un caractère élevé. On ne se lasse pas de l'entendre. Il a une façon de parler des forces de la nature qui n'appartient qu'à lui et qui ouvre, dans l'esprit de ceux qui l'écoutent, des horizons infinis.

« C'est encore son phonographe dont il aime le mieux faire les honneurs. Il cause avec lui, il l'appelle son vieux phonographe. « *How are you, old phonograph?* » lui dit-il gaiement. Il tourne

la manivelle et l'instrument lui répond de sa petite voix métallique un peu nasillarde et grondeuse, en anglais, en allemand, en espagnol ou en latin, car celui qui l'a créé parle un peu ces quatre langues et a eu soin de les lui apprendre. Vous pensez bien que l'instrument sous la main de l'inventeur fonctionne admirablement. Aussi l'impression produite sur les assistants est-elle toujours très intense.

« Les visites dureraient des journées et des nuits si le maître de Menlo-Park voulait initier ses hôtes à tous les mystères dont il est entouré.

« Lorsqu'il parle des hommes de science, c'est avec un sentiment de respect et de déférence. De tous les gens éminents avec lesquels il s'est trouvé en rapport, ce sont eux chez lesquels il a reconnu les idées les plus élevées, le plus grand désintéressement et la simplicité la plus vraie. Il parle souvent de son entrevue avec William Thompson et se plaît à rappeler que le savant avait un mauvais chapeau, des habits râpés et n'était pas mieux vêtu que lui.

« Enfin le soir arrive. Les visiteurs enchantés de leur excursion, reprennent le train; l'heure du repos a sonné pour les pauvres humains, c'est le moment où Edison commence à travailler. Il soupe, et, au milieu du silence profond de la pleine campagne, il médite, il combine, il essaie, il invente. Il prolonge sa veille longtemps après que tous ses collaborateurs sont partis. La machine à vapeur est arrêtée, les fourneaux sont éteints, l'inventeur est seul dans cet immense laboratoire, pareil à ces anciens alchimistes qui, dans le mystère des longues nuits, cherchaient, sans se lasser, la transmutation des métaux ou l'élixir de longue vie, ou à ces sorciers qui préparaient à minuit les philtres amoureux et la poudre de succession.

« L'aube le surprend parfois creusant un problème, et il n'est jamais moins de deux ou trois heures du matin quand il regagne son *home* où sa petite famille dort paisiblement, les yeux fixés vers les étoiles qu'il examine avec un intérêt passionné, trébuchant contre les cailloux et les mottes de terre. »

Voilà l'homme tout entier. Dans notre prochain numéro, nous parlerons de son œuvre dont l'Exposition internationale d'électricité va permettre à la foule encore incrédule de constater et de palper, pour ainsi dire, la saisissante réalité.

Electricité médicale. — Télégraphie. — Salle du congrès

Puis viennent les salles de l'électricité médicale, des instruments de précision, de la télégraphie électrique et de ses accessoires, des piles électriques de l'horlogerie électrique, du Musé rétrospectif où se voient de vieux instruments d l'électricité primitive, des autographes des principaux fondateurs de la science électrique. A la suite de ces salles successives, on arrive dans une autre salle d'appareils téléphoniques, puis dans la salle de lecture, qui précèdent la grande salle du congrès des Électriciens (Pavillon Nord-Est) où plus de trois cents personnes pourront trouver place. Enfin, deux pièces spéciales sont attribuées à l'Exposition spéciale d'Edison.

L'exposition de M. T. A. Edison (salles 24 et 25)

En quittant la salle du congrès, les yeux sont frappés d'un mouvement de courroies et de poulies.

On se trouve au centre du système Edison. C'est de ce point que l'opérateur contrôle et distribue sa lumière et sa force. On touche une manivelle; en un instant, la salle est aussitôt plongée dans l'obscurité, on ne voit plus briller qu'une simple lumière. Cette lumière unique est éteinte à son tour et rallumée en un instant. Un autre objet est touché, soudain un mur entier resplendit de feux, il en est de même d'un second, puis d'un troisième. Les candélabres projettent un éclat scintillant et cela se répète une douzaine de fois dans une minute.

Telle est la voie dans laquelle M. Edison est entré pour nous fournir les moyens d'animer par l'électrécité tous les instruments destinés à nos usages domestiques, ou à animer les outils de nos ateliers. Pas de moulins à faire tourner; plus de fatigue du corps et de l'esprit pour les ouvriers de nos villes industrielles. Edison a imaginé les formes multiples des applications qui nous sont utiles.

Une machine de la force d'un homme ou de 1 à 5 chevaux, à votre gré, peut être transportée dans vos demeures sans aucun danger pour votre santé, sans que par son fonctionnement il résulte aucune fatigue pour vos membres. On n'est pas forcé d'être attentif, de dépenser son énergie personnelle pour aider la machine, elle fonctionne toute seule. Nous pouvons n'utiliser que ce que nos besoins exigent et ne payer que la force que nous utilisons.

Le soir, fonctionne la grande lumière électrique, portant le nom d'Edison; on peut alors l'admirer dans toute sa splendeur.

Elle est produite par l'incandescence d'un vulgaire morceau de charbon et nous promet assurément des résultats tout à fait surprenants. Nous pourrons désormais tenir dans nos mains un candélabre électrique à 16 branches. Chose merveilleuse, il nous est possible de faire briller sous l'eau cette ravissante lumière et d'appliquer le feu sans s'éteindre sur un bloc de glace.

Il n'y a pas dans cette lumière d'intermittence qui fatigue les yeux. Elle ne produit ni odeur désagréable, ni bruit, c'est de la lumière, simple, pure, aux reflets d'or.

Avec quelle netteté cette délicieuse lumière ne fait-elle pas ressortir toutes les couleurs des beaux tableaux qui ornent le premier salon d'Edison, tableaux qui ont été le plus bel ornement du salon de MM. Arnold et Trip et dont la valeur a été estimée 250.000 francs. Avec quelle perfection elle fait valoir les nuances si pures, si fraîches des tentures artistiques qui sont exposées contre les murs et qui imitent avec une si parfaite fidélité les plus merveilleuses tapisseries des Gobelins et des autres fabriques les plus célèbres.

Les deux salons d'Edison sont, à eux seuls, une exposition complète et unique. Le télégraphe quadruplex, une des gloires du célèbre inventeur, système qui permet d'envoyer à la fois plusieurs dépêches par un seul et même fil, et ces dépêches peuvent se croiser dans un sens différent; le téléphone à charbon d'Edison, usité actuellement dans presque tous les pays du monde et qui est accompagné de modèles de toutes les formes de cet instrument, depuis la première expérience jusqu'au transmetteur de charbon compact employé pour reproduire les sons de la voix humaine: tous ces appareils sont exposés dans une collection historique qui montre à quel point le sujet a été étudié par M. Edison.

M. Edison a été le premier à se servir de cette propriété particulière du carbone pour varier la résistance des circuits télégraphiques, et avant que personne n'ait abordé cette question, il l'avait déja employé dans la construction d'une grande variété d'instruments scientifiques et pratiques parmi lesquels se trouvent le microtasimètre, le relai télégraphique et le rhéostat à charbon.

On voit aussi plusieurs formes de magnétotéléphones, construits par M. Edison bien avant que cet inventeur ait exécuté ses premiers essais de téléphone parlant.

Ici c'est le phonographe qui enregistre la parole humaine, la reproduit, et qui, par des dispositions toutes nouvelles, dont M. Edison semble seul avoir le secret, la transmet en outre à distance par le téléphone; plus loin c'est la plume électrique qui permet de reproduire une lettre, un dessin, à un nombre considérable d'exemplaires.

Puis vient l'électro-motographe d'Edison, la plus belle invention peut-être de cet incomparable inventeur, appareil étonnant qui permet de transmettre au loin la parole comme dans le téléphone, mais en la reproduisant avec son intensité naturelle.

L'électro-monographe consiste en un cylindre de chaux, d'hydrate de potasse et d'une petite quantité d'acétate de mercure, ce cylindre tourne en frictionnant légèrement une lame de platine reliée à une membrane de mica; quand les courants ondulatoires provenant d'un transmetteur à charbon, arrivent dans ce récepteur, ils traduisent leur effet en augmentant ou en diminuant la résistance due au frottement du cylindre contre le métal, et déterminent des déplacements de la lame de mica, qui vibrera synchroniquement avec le courant ondulatoire, et, par suite, synchroniquement aussi avec la lame du transmetteur. Le résultat obtenu est surprenant et ne manquera pas d'obtenir un très grand succès de la part des visiteurs.

Ces appareils si nombreux, si remarquables sont groupés avec beaucoup de méthode dans les deux salons consacrés à Edison. Cette exposition a été organisée par les soins de plusieurs collaborateurs du célèbre physicien, parmi lesquels nous citerons l'un des plus sympathiques et des plus distingués, M. Otto A. Moses. Nous devons mentionner aussi le nom de M. Charles Batchelor, un physicien de grande valeur qui ne cesse de prêter le concours de son talent à M. Edison.

1809

1814

1815

L'ÉLECTRICITÉ A LONDRES

M. Philippart! Philippart, vous savez bien, le mouvement fait homme, celui qui tombe et rebondit comme une balle élastique; Philippart admiré, puis conspué; Philippart, hier financier, aujourd'hui ingénieur; Philippart ayant toutes les énergies servies par toutes les aptitudes; M. Philippart, enfin, qui mourra dans la peau d'un millionnaire — soyez-en certain — est venu me trouver à Londres pour me prier d'assister à cette première et intéressante expérience d'un train de chemin de fer éclairé par la lumière électrique. J'ai accepté l'offre avec empressement, et je vais vous rendre compte de mes appréciations.

Quelle est la compagnie à la tête de laquelle se trouve M. Philippart? Je ne le sais trop; m'est avis que lui seul est la Compagnie, bien qu'à côté de sa personnalité se placent deux autres administrateurs, M. Ricard-Sivers et M. de Maubeuge; toujours est-il que cette Compagnie, qui a nom *Force et lumière*, dispose des brevets si importants et dont la valeur a été établie, reconnue par tous les hommes de loi du Royaume-Uni, de l'*Accumulateur électrique Faure*.

L'accumulateur électrique, on ne l'ignore pas, n'est autre chose qu'un récipient d'électricité, dans une petite boîte d'un pied de long sur six pouces de large. On emmagasine l'électricité comme sous une cloche, on condense le gaz. C'est M. Planté, qui a inventé l'accumulateur, perfectionné et rendu pratique par M. Faure.

L'électricité emmagasinée, on peut la transporter n'importe où, et la première application pratique de cet admirable agent de force et de lumière a été faite sur la ligne de Londres à Brighton, en présence de toute la presse anglaise, du ministre de la guerre, de sir Arthur Ottway; C. Edwards, membres du Parlement; C. Seymour Grenfell; colonel Moncriff; monsignor Capel; M. de Calo, ingénieur et de tout ce que Londres renferme en ce moment d'illustrations.

Ce sera un grand honneur pour M. J.-P. Knight, administrateur général du London-Brigthon et South Coast Railway d'avoir le premier ouvert une route que vont suivre bientôt toutes les lignes de chemins de fer. Je constate, en passant, que M. Knight tient en Angleterre, le premier rang parmi les directeurs et que, sympathique autant qu'habile, il marche résolûment dans la voie du progrès et que le train qu'il a organisé entre Londres et Brighton est véritablement une merveille.

Quatre voitures, dites Pullman, composent ce train. Une voiture est réservée aux fumeurs, dans une autre le restaurant est installé, la troisième et la quatrième sont des salons. Chaque voiture contient vingt-huit fauteuils mobiles, c'est-à-dire, se retournant, s'inclinant au gré de l'occupant; dans un des salons il y a un cabinet de lecture pourvu de tous les journaux et revues du monde, et je n'ai pas besoin d'ajouter que les cabinets de toilettes et autres cabinets, n'ont pas été oubliés dans cette organisation qui est le dernier mot du bien-être, car toutes les voitures du train communiquent entre elles, ce qui permet au voyageur de se dégourdir les jambes et de sortir de cette immobilité si ennuyeuse dans les trajets en chemin de fer.

Chaque wagon est éclairé par six lampes électriques, système Edison; dans le jour et lorsqu'on atteint un tunnel, ces lampes s'allument instantanément, et dans le fauteuil où l'on est confortablement assis, on peut continuer la lecture de son journal. La clarté des lampes incandescentes est pure, immobile, et n'a pas l'inconvénient des lampes ordinaires à l'huile, qui ne donnent qu'une lumière indécise, avec laquelle il est impossible de lire.

On m'a expliqué, et je l'ai compris sans peine, que le nouveau système d'éclairage coûtera beaucoup moins cher que l'ancien, puisqu'il faut moitié moins de foyers lumineux, qu'il n'y a plus d'entretien, ni de nettoyage de lampes, et que la Compagnie Philippart, lorsque son mode d'éclairage sera adopté dans l'univers entier, ce qui ne tardera pas; réalisera des bénéfices considérables, mais cela n'est point de ma compétence. Je n'ai, moi, qu'à constater le résultat de l'expérience, résultat splendide et devant lequel il faut s'incliner.

Trente accumulateurs suffisent pour éclairer le train de quatre voitures Pullman, soit dix wagons ordinaires; ces accumulateurs occupent, à l'avant du train, dans le compartiment réservé aux bagages, un espace très restreint; ils sont chargés à Londres après chaque voyage; mais, pour éviter jusqu'à ce léger embarras, à l'avenir, une petite machine dynamo, mise en mouvement par le train lui-même, approvisionnera les accumulateurs d'électricité pendant le voyage.

Sans entrer dans les détails scientifiques de l'innovation, je peux faire remarquer que la première lampe à incandescence a été inventée, il y a vingt-cinq ans, par un Français, M. de Changy; que la Belgique a acheté les brevets de M. Philippart, que l'Autriche, l'Allemagne, la Hongrie forment des Sociétés pour leur exploitation, et qu'avant un mois, trois Compagnies de chemins de

fer, en Angleterre, adopteront le nouveau mode d'éclairage; j'ajouterai enfin que, dans moins de quinze jours, dans les environs de Londres, un tramway circulera éclairé et mu par l'électricité, fournie par l'accumulateur Faure, et que j'espère bien, dans peu de temps, avoir chez moi mon petit accumulateur, me permettant de travailler le soir sans avoir les yeux brûlés par la lumière du gaz, ou sans être obligé de remonter sans cesse cette déplorable lampe à l'huile qui s'éteint toujours au moment précis où l'on en a besoin.

Du reste, nos lecteurs se rendront facilement compte de cette merveilleuse installation par le plan par nous donnons ci-contre.

T. Johnson.

1817

SIR: In turning over some old American MSS. and papers, I have come upon what appears to be the original draft of Longfellow's original poem "Caspar Becarra." Perhaps it will interest your readers.—Yours, &c., 772. 32·2.

CASPAR BECARRA EDISON.

1818

By his evening fire, the inventor
  Pondered o'er his secret shame,
Baffled, weary, and disheartened,
  Still he mused and dreamed of fame.

Electric incandescent lighting
  Long had taxed his utmost skill:
But as yet the fair ideal
  Vanished and escaped him still.

From the distant Ural mountains
  Was the precious metal brought,
Day and night the anxious master
  At his toil untiring wrought.

Till discouraged and desponding
  Sat he now in shadows deep,
And the day's humiliation
  Found oblivion in sleep.

Then a voice cried "Rise, Oh Master!
  From the burning cane and oak;
Shape the thought that stirs within thee!"
  And startled, the inventor woke.

Woke, and from the glowing embers
  Seized the charred and glowing wood,
And therefrom he made his filament,
  And he saw that it was good.

Be thou artist or inventor,
  Take this lesson to thy heart:
That is best that lieth nearest,
  Shape from that thy work of art.

1819

PATIENCE, OR PERSEVERANCE REWARDED.

T. A. E's. LAMENT.

(Air obvious.)

When I first brought this little lamp out,
I gently remarked to myself,
Its one to a million
That every civilian,
Will lay his old lamp on the shelf.
Bright genius is praised everywhere,
And I've plenty of that—and to spare;
But inventors' professions,
Though often concessions,
Of snubbing have more than their share.
  Which I never counted upon,
  When I first turned this little lamp on.

I said when I first turned it on,
Its plain to the veriest dunce,
That all gas shareholders
Will shrug up their shoulders,
And sell off their gas shares at once.
I thought I was first in the Field,
And this lamp a good income would yield;
But my hopes are all blighted,
Completely benighted,
By a Briton whose plans were concealed.
  Which I never counted upon,
  When I first turned this little lamp on.

K. M.

1820

1821

1822

1823

1824

LA SÉCURITÉ DES THÉATRES

Nous recevons de M. Maxim, l'inventeur de la fameuse lampe électrique, une lettre qui nous paraît intéressante, non seulement pour le public, mais surtout pour les directeurs de théâtre. Ceux d'entre eux qui voudront avoir des renseignements plus précis concernant l'appareil ingénieux dont il est question dans la lettre de M. Maxim, pourront s'adresser à M. N. de Kabath, 25, avenue de l'Opéra.

Paris, le 17 décembre 1881.

Monsieur,

L'incendie du Ring-Théâtre, qui suit de trop près l'incendie du théâtre de Nice, du théâtre Brooklyn, en Amérique et de tant d'autres, m'a suggéré une idée qui pourra, je crois, intéresser vos lecteurs et que je vous demande la permission de vous communiquer.

Aujourd'hui rien n'est impossible à la mécanique. Dans nos grandes filatures où d'énormes machines tissent la soie, les appareils sont si parfaits que la rupture d'un seul fil suffit pour arrêter *ipso facto* une machine de trois cents chevaux.

Dans les capsuleries d'Amérique où l'on voit des machines prendre la douille, y placer la poudre, y mettre la rondelle, y insérer la balle et fermer la capsule, sous la seule surveillance d'un ou de deux enfants, il suffit qu'*une partie* du travail ne s'accomplisse pas pour qu'aussitôt le mouvement s'arrête. De plus, une sonnette avertit que la fonction de la machine a été automatiquement interrompue.

Quand on peut, par la mécanique, obtenir des résultats aussi prodigieux comment n'a-t-on pas songé encore à veiller *automatiquement* à la sécurité des théâtres?

J'affirme qu'un *extincteur automatique*, et, comme tel, absolument indépendant de tout concours humain, rendrait impossibles les catastrophes où tant de spectateurs périssent.

Permettez-moi d'entrer dans quelques détails.

J'ai imaginé un appareil qui, placé dans un théâtre, serait relié à la conduite d'eau principale, à un réservoir, à une pompe à vapeur, ou à un générateur spécial à gaz acide carbonique.

Dès qu'un incendie éclate, la chaleur met l'appareil en mouvement et en même temps ouvre le tuyau de décharge qui lance un jet d'eau, — ou d'eau mélangée avec de l'acide carbonique sur le point exact où l'incendie vient de se déclarer.

Si l'incendie a lieu seulement dans une partie du théâtre, la décharge est dirigée uniquement sur cette partie. Si l'incendie se généralise, la chaleur fait ouvrir un plus grand nombre de tuyaux et la décharge augmente en proportion des besoins.

Cet appareil fonctionne instantanément et rien au monde ne peut l'empêcher de fonctionner.

Il met en même temps en action un système d'horlogerie qui, à son tour, fait agir un avertisseur électrique, grâce auquel les postes de pompiers, de police, etc., sont immédiatement avertis. Cet avertisseur va jusqu'à indiquer l'endroit précis où l'incendie s'est produit.

Je suis convaincu qu'un grand sinistre deviendrait impossible si tous nos théâtres étaient munis de cet appareil, pas très compliqué, ni très coûteux. Aussi ai-je cru de mon devoir de vous le faire connaître.

L'incendie dans un théâtre se propage si rapidement que tous les appareils employés jusqu'à ce jour ont été insuffisants à l'arrêter. Il faut du temps pour les mettre en état d'agir. De plus, on ne peut pas toujours compter sur leur fonctionnement. Au contraire, l'appareil automatique dont je viens de vous parler opère instantanément, et son action qui ne peut pas ne pas se produire est même plus rapide que la marche du feu.

Veuillez agréer, monsieur, etc.

Hiram S. Maxim.

M. Maxim, l'inventeur de la fameuse lampe à incandescence qui a eu tant de succès à l'Exposition d'électricité, vient d'être nommé chevalier de la Légion d'honneur.

1825

1826 1827

1828

LA FRANCE. — Feuilleton du 3 octobre 1881

LA SCIENCE

Un système pratique complet d'éclairage électrique.

Nous avons déjà eu l'occasion de faire ressortir les nombreux avantages de l'éclairage électrique sur l'éclairage au gaz. (Voir nos articles intitulés : *La Chaleur au théâtre, la Sécurité des théâtres*, etc.).

On sait si les chances d'incendies et d'explosions sont fréquentes avec l'éclairage au gaz. En outre, chacun a pu éprouver combien ce dernier chauffe et alourdit l'atmosphère des locaux où il est installé : cet inconvénient est surtout sensible dans les lieux de réunion et particulièrement dans les théâtres. Si, même en hiver, nos salles de théâtre sont de véritables fournaises, c'est bien surtout à cause de ces nombreuses flammes de gaz qui rayonnent une si énorme quantité de chaleur, qui vicient l'air en lui enlevant sa partie respirable et en y déversant une masse considérable de gaz acide carbonique asphyxiant et de vapeur d'eau à température extrêmement élevée, trop lentement expulsée par une ventilation toujours insuffisante.

Ajoutons qu'avec la lumière électrique les réparations seront bien moins souvent nécessaires, puisque l'excessive chaleur, le noir de fumée, les émanations sulfureuses et ammoniacales, etc., étant supprimés en même temps que le gaz d'éclairage, il n'y aura plus de détérioration des peintures, des tentures, des dorures, ni des pièces métalliques.

Grâce aux lampes électriques sans arc voltaïque, dites lampes à incandescence, l'éclairage électrique peut aujourd'hui réunir les qualités suivantes, qu'on s'était jusqu'ici refusé à lui reconnaître :

1° Eclat modéré des foyers, ne fatiguant en rien les yeux ;

2° Fixité absolue de la lumière : aucune variation accidentelle d'éclat ni de teinte ; pas de rayons violets, lumière sans oscillations ni scintillations, et d'une blancheur uniforme ;

3° Foyers silencieux, c'est-à-dire sans ces bruits désagréables de sifflement et de bourdonnement des foyers électriques primitifs ;

4° Réglage facile, permettant d'obtenir à volonté et d'une façon progressive, sans sauts brusques, tous les degrés d'éclairement, depuis l'éclat maximum jusqu'à celui d'une simple veilleuse ; chaque degré de lumière pouvant être maintenu aussi longtemps qu'il est nécessaire.

Il est vrai que la lumière électrique par simple incandescence demande, à puissance lumineuse égale, plus de force motrice que celle à arc voltaïque, mais elle présente, comme large compensation, les importants avantages que nous venons d'énumérer.

Parmi les lampes à incandescence, les plus simples de toutes, et les plus simples en même temps de toutes les lampes électriques, sont les lampes à incandescence pure, dans le vide, c'est-à-dire sans accompagnement de combustion : la lumière y étant uniquement due au fort échauffement provoqué par le passage du courant à travers un fil conducteur offrant une résistance suffisante à ce passage.

Le type de ces lampes est la célèbre lampe du fécond inventeur américain Edison.

L'organe lumineux de la lampe Edison, telle qu'on la voit à l'Exposition d'électricité sous sa constitution définitive, consiste en un filament de bambou carbonisé.

Ce filament, remarquable par sa solidité, est courbé en fer à cheval et logé à l'intérieur d'une ampoule de verre, en forme d'œuf, vide d'air.

Le courant électrique lui arrive par l'intermédiaire de deux fils de platine habilement scellés dans le verre de l'ampoule, et soudés aux deux extrémités du filament par des surfaces de contact assez grandes pour empêcher la chaleur de rougir ces fils, ce qui pourrait amener la fêlure du verre.

On peut suivre sur plusieurs tableaux figurant à l'exposition Edison la transformation progressive des fibres de bambou en filaments de charbon durs et résistants, ainsi que les diverses phases de la construction des lampes.

Dès qu'on lance le courant dans la lampe, le filament de charbon végétal s'échauffe et devient lumineux, et d'autant plus que le courant est plus intense. Il peut supporter sans se volatiliser une température blanche très élevée. Le vide étant fait dans l'œuf, il ne se produit aucune combustion, et le filament reste intact. Il subit pourtant à la longue une modification moléculaire, qui finit par le mettre hors de service. Mais ce n'est en moyenne qu'au bout de 1000 à 1200 heures (7 à 8 mois, à 5 heures d'éclairage par jour) qu'il faut le remplacer, ou, autrement dit, renouveler la lampe ; or, le prix de fabrique de chaque lampe n'est que d'un shelling (1 fr. 25).

La lampe Edison s'allume et s'éteint instantanément, en tournant un bouton; son pouvoir lumineux se règle à volonté par une manœuvre tout aussi simple.

Les lampes du système Edison sont incontestablement de toutes les lampes électriques celles qui se prêtent le mieux à l'éclairage domestique.

La lumière produite par ces lampes n'est plus en effet aveuglante : elle est, au con-

traire, d'une douceur remarquable. Sa fixité est absolue; jamais aucune variation accidentelle d'éclat ni de teinte. Elle se règle à volonté, c'est-à-dire qu'elle peut être fournie avec telle intensité qu'on désire, depuis l'éclat maximum, jusqu'à celui d'une simple lueur; elle peut être divisée pour ainsi dire indéfiniment; elle ne présente pas ces rayons violets de la lumière à arc voltaïque si fatigants pour la vue; lorsqu'on affaiblit progressivement son éclat, sa belle teinte blanche prend peu à peu des nuances orangées des plus agréables pour tirer ensuite sur une teinte rougeâtre pleine de douceur. Elle ne fournit absolument aucune émanation, aucune trace d'acide carbonique, elle chauffe très peu, et si jamais l'on se décide à installer définitivement la lumière électrique dans les théâtres, ce système de lampes est tout désigné. En dehors de ses avantages hygiéniques et esthétiques, c'est celui qui se prête, en effet, le mieux aux gradations de lumière nécessitées par les diverses situations scéniques : même commodité de manœuvre qu'avec le gaz, et en plus, aucun risque d'explosions ni d'incendies.

A tous ces avantages du système, la lumière Edison en joindrait un autre non moins important : c'est d'être d'un prix de revient moins élevé que celui de la lumière du gaz. Les représentants de M. Edison nous ont proposé d'étudier nous-même son système, les appareils de mesure en main, et nous assurent que nous trouverons qu'il est plus économique, dès maintenant, que l'éclairage au gaz.

On aurait donc ainsi tous les avantages à la fois à employer cette lumière qui, à éclairement égal, coûte moins cher que la lumière du gaz, et qui est en même temps d'une meilleure qualité, puisqu'elle ne donne pas d'émanations, n'appauvrit pas l'air de sa partie respirable, ne dégage pas d'acide carbonique, ne chauffe que très peu, et qui offre aussi toute sécurité puisqu'elle ne peut occasionner aucune explosion, ni aucun incendie; elle se règle comme le gaz et offre toute la commodité de celui-ci sans ses graves inconvénients.

Mais comment faire jouir pratiquement les particuliers de ces importants avantages?

On sait que la lumière électrique, de quelque nature qu'elle soit, est fournie par des machines rotatives spéciales, dites machines à lumière, soit magnéto-électriques, soit dynamo-électriques, actionnées par des machines à vapeur ou par des moteurs à gaz.

Il est clair que s'il fallait avoir chez soi ce matériel coûteux, encombrant, bruyant et trépidant, accompagné de mécaniciens spéciaux, on pourrait regarder à plusieurs fois avant de se décider à adopter ce système d'éclairage, si supérieur qu'il soit.

Mais si par une disposition très simple et très rationnelle comme celle qui a été combinée par M. Edison, on peut concentrer les organes générateurs de l'électricité sur un certain nombre de points dans une ville, comme le sont actuellement les usines à gaz, et parvenir à distribuer de ces centres l'électricité à domicile comme on y distribue actuellement le gaz, il est bien évident que ce système d'éclairage ne présenterait pas plus de difficultés d'application pratique que celui encore aujourd'hui en fonction chez nous, et que les particuliers, eu égard à la supériorité qu'il offre à tous les points de vue, s'empresseraient de l'adopter.

Or, aujourd'hui, on peut considérer ce problème comme définitivement résolu : le temps des expériences est passé. Les dispositifs qui ont été combinés depuis deux ans par M. Edison au point de vue de l'installation pratique de son système d'éclairage électrique semblent en effet ne devoir plus dès maintenant rien laisser à chercher ni à désirer, car tout a été prévu et scrupuleusement étudié.

Un bon système de lampe, comme la lampe Edison, c'est déjà beaucoup, mais ce n'est qu'un des éléments du grand ensemble qu'il s'agit d'établir.

Pour arriver à résoudre entièrement cet intéressant problème de la distribution économique de l'éclairage électrique, il faut encore :

1° Construire le générateur de courants électriques le mieux approprié à cette distribution et au service des lampes spéciales adoptées;

2° Adapter ledit générateur à ses fonctions dans les conditions les plus économiques possibles;

3° Disposer un circuit aussi peu résistant que possible au passage du courant électrique, et aussi bien isolé que possible;

4° Trouver la disposition de ce circuit la meilleure pour obtenir une division suffisante du courant, tout en rendant les lampes et les groupes de lampes complètement indépendants les uns des autres;

5° Disposer la canalisation des fils conducteurs et les prises de courant sur ces fils assez simplement pour rendre faciles les recherches et les réparations;

6° Faire en sorte que l'extinction inattendue d'un nombre plus ou moins considérable de lampes alimentées par un même générateur électrique de l'usine centrale n'entraîne aucune variation d'intensité lumineuse chez les autres lampes encore en fonction sur le même réseau.

8° Pour éviter la production en pure perte du travail moteur, faire en sorte que le générateur électrique et le moteur qui l'anime règlent d'eux-mêmes, automatiquement, leur allure selon la quantité d'électricité à produire utilement.

7° Faire en sorte qu'en cas d'une augmentation passagère (il faut tout prévoir) de l'intensité du courant, la trop grande exagération calorifique qui pourrait en résulter ne détériore pas les lampes. S'arranger de manière à ce que, dans aucun cas, les lampes ne reçoivent jamais plus de courant qu'elles ne peuvent en supporter.

9° Pouvoir, par une manœuvre aussi simple que celle d'un robinet de bec de gaz, non seulement allumer et éteindre isolément et collectivement les lampes, mais encore affaiblir ou augmenter à volonté leur intensité lumineuse. Bien établir les communications conductrices à travers les supports. En outre, éviter la détérioration des pièces conductrices de contact par l'action de l'étincelle qui se produit entr'elles au moment où l'on interrompt le courant dans une lampe pour l'éteindre.

10° Pouvoir, comme cela se fait pour le gaz, des usines centrales d'où part et d'où est distribuée l'électricité, contrôler l'intensité du courant circulant dans tout le réseau, voir de combien il faut augmenter ou diminuer cette intensité pour correspondre à un pouvoir lumineux déterminé, et maintenir constant un régime convenu d'intensité électrique sur tous les points du réseau, afin que le consommateur ait toujours une somme de lumière suffisante et toujours égale à celle qu'on s'est engagé à lui fournir.

11° Pouvoir, comme on le fait pour le gaz, mesurer exactement la quantité d'électricité consommée par chaque particulier : c'est-à-dire disposer des *compteurs* d'électricité.

Or, tous ces problèmes ont été résolus dans le système de M. Edison. Nos lecteurs pourront en voir les ingénieux dispositifs au Palais de l'Industrie, à côté des autres nombreux appareils créés par le célèbre inventeur américain : phonographe, télégraphe quadruplex, télégraphe automatique, télégraphe autographique, plume électrique, électromotographe, téléphone musical, téléphone parlant à haute voix (*loud speaking*), téléphonographe, etc., etc.

Il est à remarquer que le système Edison de transport et de distribution électrique peut fournir aussi la puissance motrice pour les habitations particulières et la petite industrie.

On pourra ainsi plus économiquement que par les moyens directs, actionner par voie électrique des ascenseurs, des monte-charges, des pompes, des presses, des tours, des machines à coudre et toutes sortes d'autres outils : ce sera ainsi la suppression des moteurs à domicile.

L'éclairage électrique distribué dans les villes, tel qu'il l'est, par exemple, par le système Edison, présente encore sur l'éclairage au gaz les avantages suivants :

1° Le matériel pour produire une quantité déterminée de lumière est beaucoup moindre pour l'électricité que pour le gaz;

2° L'emplacement est aussi beaucoup moindre, et, par suite, le loyer. Les Compagnies d'électricité n'auront besoin ni de grands terrains, ni même de constructions spéciales pour le service de leurs usines : elles pourront louer des ateliers ordinaires;

3° L'amortissement du capital engagé est beaucoup plus faible;

4° La main-d'œuvre journalière coûtera moins cher que pour une usine à gaz de production lumineuse équivalente;

5° La canalisation est beaucoup plus simple et beaucoup moins coûteuse :

Il n'est plus, en effet, nécessaire de creuser des tranchées spéciales, si dispendieuses, surtout pour les grosses conduites de gaz, comme celle qu'on a posée l'année dernière de l'usine de Clichy au Théâtre-Français : les conducteurs électriques, même les plus gros, peuvent être fixés simplement à la voûte des égouts, où ils sont toujours facilement accessibles. Le travail énorme que nécessitent la pose et la réparation des conduites de gaz sera des plus simplifiés pour les conducteurs; en outre, la circulation ne sera plus entravée dans les rues par les travaux de terrassement interminables et indéfiniment renouvelés sur tous les points de la ville.

Comme on vient de le voir, l'éclairage électrique se trouve avec le système Edison dans les mêmes conditions de distribution et de commodité d'emploi que l'éclairage au gaz, mais avec, en plus, tous les nombreux avantages de premier ordre que nous avons indiqués, parmi lesquels, ne l'oublions pas, figure, nous assure-t-on formellement, celui de l'économie. L'éclairage électrique fait dans de telles conditions est évidemment appelé à se substituer bientôt partout à l'éclairage au gaz.

Le nombre et la puissance des foyers desservis par la canalisation électrique urbaine seront naturellement proportionnés à la largeur des rues et des places, ainsi qu'à la nature et à l'étendue des locaux publics et privés.

Dès maintenant, le grand ensemble qui constitue le système Edison est absolument complet dans toutes ses parties, et il paraît certain qu'il a désormais atteint le plus haut degré de simplicité, d'économie, de praticabilité et de confortable qu'on puisse désirer. Tout est prêt actuellement pour une application sur l'échelle la plus large, et il est à prévoir que les grandes villes de l'Europe ne tarderont pas à suivre l'exemple de New-York, qui a déjà installé le système Edison sur une grande partie de sa vaste étendue.

E. VIGNES.

EXPOSITION INTERNATIONALE D'ELECTRICITE

1829

L'EXPOSITION DE M. EDISON

La Correspondance de Paris Sept 26th

La gravure que nous publions aujourd'hui représente l'un des salons où sont exposés les appareils de M. Edison, au Palais de l'Industrie. Ses télégraphes, ses téléphones, ses phonographes, ses instruments de précision, ses aimants diviseurs de minerais, etc., tiennent une large place, mais la plus importante est occupée par son système d'éclairage. Le savant américain a pourvu sa lampe d'organes si pratiques, si ingénieusement appropriés à tous nos usages domestiques, que l'attention publique est vivement surexcitée par l'exposition de ce système, dont la prochaine mise en pratique va modifier profondément nos habitudes.

C'est la lampe Edison qui brille dans les lustres de ses salons et sur les branches de toutes formes disposées autour des murs. C'est elle que les curieux examinent sur les chandeliers portatifs des trois tables placés au premier plan de notre dessin. Elle donne une lumière douce, fixe, d'une couleur et d'une intensité semblables à celle du gaz. Comme elle brille autour d'un filament de charbon recourbé en ∩ et renfermé dans un globe dans lequel le vide est opéré, elle ne dégage ni odeur, ni fumée, et si peu de chaleur qu'on peut la presser dans sa main sans ressentir aucune sensation brûlante.

M. Edison, au lieu de la pourvoir d'armatures délicates et encombrantes pour amener l'électricité à l'intérieur, a simplement fermé la partie inférieure du globe par un tampon en plâtre dans lequel deux anneaux en cuivre sont scellés. Chacun de ces deux anneaux est soudé à l'un des deux fils de platine de l'intérieur où viennent aboutir les deux extrémités du filament de charbon. Le contact avec le circuit électrique de l'extérieur s'établit par les anneaux. L'un d'eux est pourvu d'un pas de vis, de sorte qu'on peut poser la lampe sur un support quelconque où un pas de vis semblable aura été ménagé.

Cette courte description suffit pour mettre en relief ce qu'ont de commode le maniement de la lampe et les combinaisons variées des candélabres, des supports, des chandeliers auxquels elle se prête. On peut voir, dans les salons de M. Edison, des branches pivotantes, en deux ou trois parties, semblables à celles communément employées pour le gaz dans les ateliers ou dans les bureaux.

Les lustres, les appliques où ses lampes resplendissent aussi, indiquent suffisamment que le temps des bougies et des lampes à huile est passé pour l'éclairage de nos appartements les plus élégants, de même que ses chandeliers seront bientôt dans toutes les demeures éclairées encore avec pétrole ou avec d'autres essences non moins incommodes et dangereuses.

Ce qui permet à la lampe Edison de se propager ainsi c'est d'abord les avantages que nous venons d'énumérer. Ensuite et surtout, c'est la canalisation merveilleuse dont son illustre inventeur l'a pourvue.

Elle se compose de trois parties : 1° la canalisation des rues; 2° la canalisation des immeubles; 3° la canalisation des appartements. On peut voir sur des tables, à droite et au fond de la salle que nous représentons, des échantillons de canalisation : celle des rues, formée de tuyaux en fer de 5 centimètres de diamètre, remplis d'une matière isolante, traversée par deux conducteurs en cuivre reliés à la machine dynamo-électrique; les boîtes de jonction, d'où les tuyaux rayonnent en trois ou quatre directions différentes; les formes cintrées qu'elles peuvent prendre.

1830

La canalisation des immeubles a la même forme que celle des rues, avec un diamètre plus petit, puisqu'elle a moins d'électricité à transporter; celle des maisons est composée de deux fils garnis d'une enveloppe de coton incombustible.

Les conducteurs de toutes ces canalisations sont reliés les uns aux autres par dérivation, dans des boîtes de jonction, dont la grandeur est proportionnée à l'importance de leurs fonctions. M. Edison opère ces jonctions à l'aide d'armatures qui conservent aux fils une indépendance telle qu'un accident, un éboulement, une rupture peuvent se produire sur un point sans que cela ait aucune conséquence fâcheuse pour les autres parties du système.

Il a interposé aussi, dans toutes les boîtes, des fils de plomb pour neutraliser les dangers d'incendie; si, par suite d'une trop forte tension électrique, la température des fils devenait trop élevée, le plomb fondrait et le courant serait interrompu.

C'est là un accident qui ne peut guère se produire dans le système Edison, car son régulateur de tension, qu'on peut voir sur une table au milieu de notre dessin, permet de régulariser, suivant les besoins de la consommation, la quantité d'électricité à envoyer dans les conducteurs.

La lumière Edison est livrée au prix du gaz en Amérique, où elle éclaire nombre d'industries et d'habitations. Chaque particulier possède un compteur d'électricité Edison. C'est un instrument fort simple, construit d'après ce principe qu'un courant électrique, traversant une solution métallique, décompose cette solution : la décomposition s'opère en proportion de la durée du courant. Le compteur Edison se compose donc d'un vase plein d'une solution semblable traversée par les fils. Le métal déposé au fond est recueilli à la fin de chaque mois et les dépenses sont calculées en conséquence.

Il est aisé de juger, par ces détails, jusqu'à quel point l'illustre solitaire de Menlo-Park a, ainsi que nous le disons en commençant, pourvu son système d'éclairage d'organes appropriés à toutes ses exigences. Nous ne faisons ici que relever ce qui se dit couramment parmi les visiteurs du Palais de l'Industrie, en désignant le système d'éclairage Edison comme appelé à remplacer très prochainement tous les systèmes en usage.

1831

1832

THE DAILY CHRONICLE, THURSDAY, DECEMBER 15, 1881.

ELECTRIC LIGHTING. 1833

At a crowded meeting of the members of the Society of Arts held last night at their premises at John-street, Adelphi, Mr. W. H. Preece, F.R.S., read a paper entitled "Electric Lighting at the Paris Exhibition." Sir Frederick J. Bramwell, F.R.S., chairman of the Council, presided. The room was illuminated by the Edison's incandescent lamps.

Mr. PREECE said that the recent International Exhibition of Electricity in Paris, marked an epoch in the history of the practical applications of that science to arts, manufactures, and commerce. He proposed on that occasion to refer only to its application to artificial illumination. It was as an exhibition of electric lighting that it was principally attractive, and those who saw it for the first time would never forget the vivid impression that the great blaze of splendour produced upon their minds on entering the building. There never could be anything like it again, for as wisdom grew with experience, no managers of future exhibitions were likely to repeat that terrific *mélange* of lights that flooded the interior of the Palais de l'Industrie with great brilliancy, but with an impracticable and impossible means of comparing and judging the relative merits of systems. For instance, at the forthcoming exhibition at the Crystal Palace, the building—splendidly adapted for the purpose—would be divided into sections, each section being lit by one, and only one system. He only purposed to select what appeared to him to be novelties and what seemed worthy of bringing to their notice as steps in advance. On the night of Aug. 29 there were in operation 277 arc lamps, 116 candles, 44 arc incandescent lamps, 1,500 incandescent lamps, or a total of 1,837 electric light in all, at the Paris Exhibition. Towards the end of the period during which the show was opened this number was very largely increased, and he had little doubt that the number reached 2,500 in the beginning of November. The exhibition of engines and machinery was very extensive, although English manufacturers failed to do what they might have done had they thought as highly of the exhibition at first as they did afterwards. The only extensive display was by Messrs. Robey, of Lincoln, to whom they were indebted for the engine which was used that evening. The display of lamps was the display of the building. There were very few novelties among arc lamps. The lampe soleil, which holds an intermediate position between arc and incandescent lamps, made a very effective display in the picture-gallery, where there were 20 lamps in 10 lanterns. It is to be seen in London lighting up the panorama in Westminster, and is a fixed, steady, durable lamp, giving a soft yellowish light. No one could deny that the Jablochkoff candle had done good service in the cause of electric lighting; but he was afraid that the exhibition in Paris had sounded the knell of all forms of candle, as well as those of the Werdorman type. The rising favourite is the incandescent lamp, pure and simple. The display made by Mr. Swan in the buffet of the exhibition in the Congress Hall, and in the Pavilion at the Post-office, was brilliant and effective. The light was soft, uniform, and yellow. The incandescent light is totally free from those bright rays that are so injurious to the eyes, so uncomplimentary to the complexion, and so irritating to the worker, if they are accompanied with the least unsteadiness. It is so readily under control; it requires no skilled labour to replace it or attend to it: it can be fixed anywhere; it can be worked into the fixtures and decorations of a room, and it does not damage them, as gas and oil do. Incandescent lamps can be worked by either continuous or alternate current machines. In fact, the chief lesson of the Paris Exhibition was this, that the arc light is suited only for external illumination, and that incandescent lamps are eminently adapted for internal and for domestic illumination. The lesson had been carried into practice at the Savoy Theatre, where nothing could be more effective or more efficient than the illumination of the auditorium. One could breathe pure air, feel cool, and sit out a play without incurring a headache. There were several incandescent lamps shown at Paris besides those of Mr. Swan, notably those of Maxim and Lane-Fox; but that which possessed the greatest novelty, and was decidedly the most efficient, was that of Mr. Edison. The distinctive character of the Edison lamp is the remarkable uniformity of its texture and light-giving power. Many devices were shown for measuring the quantity of electricity consumed in any place by electric lamps; but that adopted by Mr. Edison, was sufficiently simple and accurate for all practical purposes. The proper distribution of light was a problem that remained to be solved, and curiously enough nothing whatever was done in Paris to improve the illumination of streets. Street illumination in England by electricity up to the present time was, as a rule, a questionable success. It was true that those parts lighted by electricity were better than places where gas was used, but the lighting by electricity was not one-tenth what it should be if the lamps were properly distributed. What was required was that lamps suspended in the centre of the road, so that the light should be properly and uniformly distributed. The question remained for discussion, Has the electric light been brought within the region of practical domestics? He had no hesitation in saying that it had; but whether it could be brought into economical contrast with gas, experience alone would show. Several houses were already illuminated by its agency. Others are in hand, and on a future occasion he hoped to be able, from the experiences of his own household to answer the question which everyone was asking, "How much is it to cost to light one's house with electricity?" There was no use blinking their eyes to the fact that electricity could be a dangerous servant in the hands of the careless and ignorant; in the hands of the skilled it had less danger than gas, or even oil. In Paris there were no less than five incipient fires, from the wires coming in contact with each other in the Exhibition building. The instances in New York were so numerous that the Board of Fire Underwriters had issued a series of instructions, but an additional security was obtained by Mr. Edison, by inserting in every branch wire a "safety catch," which is a short piece of lead wire that instantly melts if the strength of the current exceeds a certain value, and thus ruptures the circuit, stopping the flow of electricity, and producing safety. The completeness of Mr. Edison's exhibit was certainly the most noteworthy object in the exhibition. Many unkind things had been said of Mr. Edison and his promises; perhaps no one had been severer in this direction than he (Mr. Preece) had. It was some gratification for him, therefore, to be able to announce his belief that Mr. Edison had at last solved the problem that he set himself to solve. It might be taken as a rule that any system dependent on the exercise of abnormal energy is certain sooner or later to break down. All of the hated personal supervision, and personal supervision at home, was a species of abnormal energy. This was the great secret of the success of gas. It was the cause of the slow progress of the arc light; but it was because the incandescent light promised to rival gas in this respect that such a future was open to it. He had no doubt that the Crystal Palace Exhibition would be as interesting as that at Paris, and at the former they would see some of those beautiful courts—the Alhambra for instance—lit up and shown in a way seldom, if ever, seen before. (Cheers.)

Mr. EDWARD H. JOHNSON, the representative of Mr. Edison, said that Mr. Edison contemplated the manufacture of electricity on a large scale at a common central station, and the distribution of that electricity throughout every portion of the area of a city, to be used by the uneducated and unscientific public, without the supervision of experts in the employ of the company. They proposed to put such lamps as might be seen in that room in their houses, with such provisions as to render their supervision entirely unnecessary, and which might be placed under the care of ordinary house servants, and in their hands, no matter how ignorant they might be, no damage or waste was possible. This electricity converted into light might also be converted into power by the electric motor, and they might use electricity for any purpose for which electricity had hitherto been used. Mr. Johnson then showed the rapidity with which the light could be reduced or extinguished and renewed and increased, and a portable lamp was handed round the room.

Sir H. TYLER, M.P., Mr. CROMPTON, and others thought that more prominence should have been given to other systems.

The CHAIRMAN said that they had before them an excellent example of incandescent light, and if it could be introduced into houses at the same cost as gas he was sure they would willingly use it. If they could have electricity laid on to houses there was no doubt that the problem would be, to a great extent, solved.

Mr. PREECE, in replying to a vote of thanks, said it would have been waste of time for him to have given a description of lamps and processes that had been brought before the society more than once.

The meeting then separated.

1834

1835

1836

ELECTRIC LIGHTING AT THE PARIS EXHIBITION.

By William Henry Preece, F.R.S.

The recent International Exhibition of Electricity in Paris marks an epoch in the history of the practical applications of that science to Arts, Manufactures, and Commerce. I purpose to-night to refer only to its application to artificial illumination; but there are many other branches fully deserving examination and discussion by this Society. It was, however, as an exhibition of electric lighting that it was principally attractive, and those who saw it for the first time will never forget the vivid impression that the great blaze of splendour produced upon their minds on entering the building. There never can be anything like it again, for as wisdom grows with experience, so no manager of any future Exhibition is likely to repeat that terrific *mélange* of lights that flooded the interior of the Palais de l'Industrie with great brilliancy, but with an impracticable and impossible means of comparing and judging the relative merits of different systems.

For instance, at the forthcoming Exhibition at the Crystal Palace, the building—splendidly adapted for the purpose—will be divided into sections, each section being lit by one, and only one system. But at Paris, Pelion was piled upon Ossa; the British Section, for instance, received rays from at least a dozen different sources. To estimate the value of a Siemens lamp you had to eliminate the disturbing influence of a blazing Crompton; and to admire the star-like Jaspar arc, you had to run the gauntlet of a flock of Swans. The fretful Jamin, or the fitful Jablochkoff, was masked by the steady Gülcher or the brilliant Serrin. In the galleries, however, it was different. Here, different *salles* were illuminated by different systems; a small theatre was lit by the Werderman lamp, and a picture gallery most effectively shown up by the *Lampe Soleil;* a buffet was softly and brightly lit up with the Swan lamp, while Mr. Edison's numerous exhibits, in his own *salons*, were as visible by night as by day, thanks to his own beautiful lamp.

It is not my intention to examine, *seriatim*, the various machines, lamps, and modes of illumination shown. With most of them, you are already familiar. But I purpose to select what appeared to me to be novelties, and what seemed worthy of being brought to your notice, as steps in advance.

On the night of August 29th, there were in operation 277 arc lamps, 116 candles, 44 arc incandescent lamps, 1,500 incandescent lamps, or a total of 1,837 electric lights in all, at the Paris Exhibition. Towards the end of the period during which the show was opened, this number was very largely increased, and I have little doubt that the number reached 2,500 in the beginning of November. Now this army of lamps required power to convert the energy stored up in coal into energy of motion; dynamo-machines to convert the energy of motion into electrical energy; conductors to transport this electric energy to the point to be illuminated; lamps to convert the electric energy into energy of heat, and therefore of light.

The exhibition of engines and machinery was very extensive, although our English manufacturers failed to do what they might have done had they thought as highly of the Exhibition at first as they did afterwards. Many of our manufacturers were conspicuous by their absence. The only extensive display was by Messrs. Robey and Co., of Lincoln, who showed eight of their well-known engines, with a total power of 250 horses, and I have every reason to believe that their success has amply repaid them for their enterprise. Mr. Brotherhood made a small show of his well-known three-cylinder engines and Messrs. Wallis and Stevens, of Basingstoke sent one of their semi-fixed steam-engines, with their pretty and effective governor for adjusting the speed while in motion—uniformity in speed being an essential criterion of an electric-light engine. The foreigners, for a wonder, far outshone the British in the magnitude of their displays.

One of the most valuable exhibits was made by Messrs. Thomson, Sterne, and Co., who showed a new gas-engine on a new principle, which attracted a great deal of attention. Gas is destined to play a most important *rôle* in the future of electric lighting. Its function is that of a heat-generator. The energy of the coal exists in gas in a form which can develop more light, when converted into the form of electricity, by the current, than in the form of heat by combustion. Gas-engines have a very high theoretical efficiency, and they are free from the dangers of boilers, the neglect of stokers, or the waste of energy in chimneys.

Gas-engines on the "Otto" principle, from half horse-power to 50-horse power, were very extensively exhibited by France, but the machine of Thomson, Sterne, and Co. (Clerk's

patent) excelled them all in lightness, compactness, regularity, and safety. One of these engines may now be seen at work at the Smoke Abatement Exhibition at South Kensington, and several have been ordered for private houses. As an adjunct to the gas-engine, Mr. Dowson exhibited an interesting and valuable process of making cheap gas for motor purposes. Prof. Ayrton reported that in a series of trials made with a $3\frac{1}{2}$ h.p. (nominal) "Otto" engine, driven by the Dowson gas, one h.p. (indicated) was obtained per hour by the consumption of gas derived from 1·46 lb. of coal. For larger engines he anticipated a consumption of only 1·2 lbs. per indicated horse-power per hour. You will have a paper during the Session by Mr. Dowson himself, describing his mode of manufacture. When perhaps 6 lbs. of coal per horse-power per hour are consumed in the present electric-light steam-engines, you can form some idea of the economy to be effected by cheap gas.

Dynamo-machines—machines which convert the energy of motion into electrical energy, through the medium of magnetism—were exhibited in abundance, of all kinds and forms, from the original apparatus of Faraday, made with his own hands, to Mr. Edison's latest development of this wonderful source of electric currents. There are two kinds of machines—the one producing currents from fixed and permanent steel magnets, the other from electro-magnets, excited by the currents which they themselves generate. Each kind is also subdivided into two others, in one of which continuous currents are produced, flowing in one direction, called the *continuous current machine;* and in the other alternate currents, called the *alternate current machine*, where the current rapidly reverses and changes its direction. The production of currents by these machines is due to the simple fact discovered by Faraday, that if a conductor, such as a copper wire, be moved rapidly through a magnetised space, or a magnetic field, as it is called, this conductor is electrified so that, if its two ends be connected, a current flows. The intensity of this current depends, first, on the intensity of the magnetism present, on the velocity with which the conductor moves through the field, and on the direction with which it cuts the lines of magnetic force which permeate the magnetic field. The magneto-electric kind—the manufacture and invention of M. de Meritens—are very much approved of by our Trinity House for lighthouse purposes, and a very fine display of them was made by M. de Meritens, who seemed to live in the Exhibition, for he was always there, and who never seemed to tire of giving his clear and able descriptions. He exhibited alternate and continuous current machines, and he richly deserved the gold medal that was accorded to him. The exhibition of dynamo-machines was rendered very interesting by the exhibition of an early machine of Elias, of Haarlem, of 1842, and of Pacinotti's machines of 1861. The former was shown in the Dutch Section, and the latter in the Italian. Here we have the germs of all the present machines, and by whatever name a machine may be known, it can be traced back to these original types. The Pacinotti apparatus has been very greatly improved by Gramme, and by Siemens—forms well known to every one—but it has received its greatest development in the Edison machine, which was one of the wonders of the Exhibition. As this was one of the greatest novelties, I must briefly describe it. In the first place, I must point out that the machine is larger than any one that has ever been made before. It weighs, with engine and bed plates, 20 tons, and it can produce a current of electricity of nearly 900 ampères.* As the largest machine of the Gramme type weighs scarcely one ton, and produces a current of but 93 ampères, the difference becomes striking. Now, Mr. Edison has struck out three new paths, first—in the bulk and form of his electro-magnets, second—in the size and construction of his armature, and third—in the low resistance of his revolving coil. By the first, he secures an intense and concentrated magnetic field, by the second he secures a high cutting velocity for the moving conductor through this field, and by the third, he secures a very powerful current to be distributed among a great number of lamps with the least possible waste of energy. The long and bulky coils, 8 feet long, which constitute his electro-magnet, have excited the surprise of many electricians, but there is no doubt that he has arrived at this form after many careful practical experiments, supported by the mathematical investigations of Professor Rowland—a very high authority—and that the result is to obtain an intense field in a large space, with the least absorption of electrical energy in the coils. With 350 revolutions per minute he is able to produce an electro-motive force of 110 volts, which an ordinary Gramme machine can only attain with over 1,000 revolutions per minute. His field-magnets are wound with copper wire, which have a resistance of 30 ohms, and which are connected as a shunt to the main circuit, as was originally done by Wheatstone, and is now followed by Dr. Siemens and Sir William Thomson. The armature is not wound with wire, but is constructed with solid bars of copper $\frac{3}{4}$ in. by $\frac{1}{2}$ in. section, and $3\frac{1}{4}$ feet long, which are well insulated from each other, and are most ingeniously connected at their ends by copper discs, so that all the bars, of which there are 138, form one continuous circuit, whose total resistance is only 0·008 of an ohm. The diameter of the armature is 28 inches. The core of the armature is made up of 1,700 thin iron discs insulated from each other by paper, and well clamped into a solid mass by bolts. This is done to avoid the heating effects due to so-called Foucault currents induced in the metal and absorbing or wasting energy. The iron core of the armature becomes thus magnetised, and it concentrates the field to the space through which the conductor moves, as is done in Siemens's and other machines.

* The largest Brush machine weighs two tons, and absorbs 40-horse power.

There are two great troubles in existing machines, want of uniformity in their motion and the slipping of belts. The former is met by governors, and the latter by direct gearing. Steadiness of motion is most essential, otherwise we have that painful throbbing of the light that is so irritating to the eyes. Mr. Edison connects his armature direct to his steam motor, which is a high-pressure engine of the Allen-Porter type, governed by an ingenious centrifugal regulator, and rotating very uniformly at 350 revolutions per minute, without any multiplying gear whatever. When the machine is giving out its maximum commercial effect it absorbs 125-horse power, the external resistance should be 16 times that of the armature, the electromotive force 110 volts, and the current consequently 860 ampères. It is not safe to exceed this limit, for the armature then becomes unduly heated. A special blower is added to direct cold air on the armature to keep down the heat, when the work of the machine approaches its limit. The brush is a special feature of the machine. The absence of sparking was very striking. Mr. Edison coats his brush and commutator with an amalgam of copper, which diminishes the electrical resistance of contact, reduces the heat, and prevents sparking.

Those who are interested in this machine—and everyone should be, for it is a decided step in advance—will soon have an opportunity of seeing it at work at 57, High Holborn.

There was a very interesting form of Gramme machine shown, which was maintained at a velocity of 2,400 revolutions per minute, and was said to generate an electromotive force of 2,000 volts. It maintained 60 Jamin candles alight. But one of the best and most compact forms of Gramme was that shown by the British Electric Light Company, designed by their engineer, and made for them by Messrs. Emerson, in Stockport.

The display of lamps was the display of the building. There were very few novelties among arc lamps. An arc lamp consists of two sticks or rods of carbon, which are kept apart a small fraction of an inch while the current flows through them, but which come together when the current ceases. Across the interval separating them there is a steady flow of electricity, accompanied by a slow consumption of the carbon of each rod. This flow of electricity produces high temperature, and intense incandescence and combustion of the carbon particles. This is the arc. One lamp differs from another only in the way in which the carbons are moved forward as they consume, so as to maintain the resistance equal and the right steady. Among arc lamps, that which signalled itself out among all its compeers, for steadiness and brilliancy, was the Jaspar lamp, exhibited in the Belgian Section; but it had the disadvantage of absorbing all the energy of one machine. Among those that admitted of having a number on one section, perhaps the simplest in its construction was the Gülcher, exhibited in the Austrian Section; but the most effective and original was the "Pilsen" lamp, the invention of Messrs. Piette and Krisik. It is called the "Pilsen" lamp, from the place of its birth, and from the want of euphoniousness in the names of its inventors. It was exhibited in the Austrian Section, and also in the British Section, by Mr. Fyfe. The carbons are kept apart by a sucking coil when the current flows; they are regulated by a second sucking coil worked on a shunt. The peculiarity of the lamp consists principally in the shape of the core that controls the carbon—it is wedge-shaped at each end; in action is wonderfully regular, and almost perfect. Six lamps were worked in one circuit by a Schuckert machine.

The *Lampe Soleil*, which holds an intermediate position between arc and incandescent lamps, made a very effective display in the picture-gallery, where there were 20 lamps in 10 lanterns. It is to be seen in London

lighting up the Panorama in Westminster. It is a fixed, steady, durable lamp, giving a soft yellowish light, which is due to the fact that the arc maintains in incandescence a highly refractory substance like marble, between the two ends at the carbon. It is a very simple lamp, for it involves no mechanism whatever; but it is said to absorb a great deal of power, though I have seen no reliable figures of its performance. Its consumption of carbon is remarkably small. It is worked by an alternate current machine, which, like most of these machines, made a most unpleasant hum.

Carré made a very fine display of carbons for arc lights, for the manufacture of which he is so famous, in which the regularity of form, of structure, and of composition, is said to be absolute; but it is very questionable whether this is really the case in practice, for the irregularity of the arc lights is chiefly due to impurities and irregularities in the carbon. Moreover, the very vast discrepancies that are found in the photometric measurements of the same lamp at different times, or by different persons, may be due to the irregularities in the structure of the artificial carbon rods.

No one can deny that the Jablockhoff candle has done good service in the cause of electric lighting; but I am afraid that the Exhibition in Paris has sounded the knell of all forms of candle, as well as those of the Werderman type. The rising favourite is the incandescent lamp, pure and simple. The display made by Mr. Swan in the buffet, in the Congress Hall, and in the Pavilion at the Post-office, was brilliant and effective. The light was soft, uniform, and yellow. The incandescent light is totally free from those bright rays that are so injurious to the eyes, so uncomplimentary to the complexion, and so irritating to the worker, if they are accompanied with the least unsteadiness. It is so readily under control; it requires no skilled labour to replace it or attend to it; it can be fixed anywhere; it can be worked into the fixtures and decorations of a room, and it does not damage them, as gas and oil do. Incandescent lamps can be worked by either continuous or alternate current machines. In fact, the chief lesson of the Paris Exhibition is this, that the arc light is specially suited for external illumination, and that incandescent lamps are eminently adapted for internal and for domestic illumination. This lesson has been carried into practice at the Savoy Theatre, where nothing can be more effective or more efficient than the illumination of the auditorium. One can breathe pure air, feel cool, and can sit out a play without incurring a headache. There were several incandescent lamps shown at Paris besides those of Mr. Swan, notably those of Maxim and Lane-Fox; but that which possessed the greatest novelty, and was decidedly the most efficient, was that of Mr. Edison. The distinctive character of the Edison lamp is the remarkable uniformity of its texture and light-giving power. The lamp consists of a fine filament of carbon inserted as a part of the electric circuit in a glass globe, which has been exhausted of air to the utmost limit of workshop skill. A fine, uniform quality of Japanese bamboo has been selected as that which gives the finest filament for carbonising. The bamboo is cut by special machinery into the required dimensions, and inserted in a mould, which is placed in a furnace, and raised to a very high temperature, and from which the filament comes out shaped and carbonised. Naturally grown vegetable fibre has been found to give a more uniform texture than any artificially-formed carbon. The ends are cut flat, and squeezed inside copper clamps, which are then welded together by electro-plating. The copper clamps being soldered to platinum leads that are sealed through the glass, and are connected to the conductors. Perfect sealing is obtained by flattening the mass of the tube, through which the fine platinum wires pass, into a solid bar, so as to well fuse the wires and glass together. It is a fortunate thing for the permanence of the incandescent lamp that the co-efficient of expansion, due to heat, of glass and platinum is practically the same.

The normal lamp consists of a filament 6 inches long, which gives a resistance of 240 ohms when cold, and, when permeated by a current of 0·8 ampère, gives a light equivalent to 16 sperm candles. The half lamp is constructed with a carbon filament of just half the length and half the resistance, and gives eight candles. Other lamps are made with two and with four horseshoe filaments, so as to increase the light-giving power. The features of carbon, which render it so highly adapted for incandescence, are its electrical resistance, its high refractory character, and its stability. The illumination of a filament and its durability are functions of the current that passes; the more intense the current, the higher the temperature, and therefore the brighter the light, and the shorter its life. At a temperature of about 1,000° carbon becomes red, at 2,000° it is white, and the higher the temperature, the whiter it gets, until it fuses. A current of 0·8

of an ampère maintains an Edison filament at about 2,000°, when it gives a light of 16 candles, and it lasts on an average 1,000 hours. A stronger current will give a much better light, but the carbon will not last so long. If it were possible to find a form of carbon, or any other material, which would be so refractory that we could transmit through it much stronger currents, the incandescent lamp would rival the arc lamp in brilliancy and power.

The destruction of the carbon filament in incandescent lamps is due to what is called the Crookes' effect, a very slow transference of carbon, in a molecular shower, from the one heel to the other heel of the horseshoe, until a breakdown takes place at the former point. The better the vacuum the slower this effect. Alternate current machines are said to lengthen the life of the carbons, by equalising the distribution of molecules on each heel, but they do so at the expense of efficiency.

Many devices were shown for measuring the quantity of electricity consumed in any place by electric lamps; but that adopted by Mr. Edison is sufficiently simple and accurate for all practical purposes. A glass cell contains two copper plates immersed in a solution of sulphate of copper. A definite proportion (0·001) of the current that passes through the house passes also through this cell, and removes copper from one plate and deposits copper on one plate. The weight of copper deposited is an exact measure of the current used. There are two such cells—the one in charge of the consumer and the other of the supplier. They thus check each other.

Various plans were shown in different parts of the Exhibition to diffuse the light, but the most effective was that in *Salle* 15, where a Jaspar lamp filled the room with a shadowless light, by throwing a light on to a white screen above the lamp, whence it was scattered. The lamp itself was invisible. This plan is not novel. It was suggested by the Duke of Sutherland, and has been adopted by Mr. Schwendler in India.

The proper distribution of light is a problem that remains to be solved. It is argued that an arc is so much superior to an incandescent light, that one-horse power in the former gives you ten times more light than in the latter. This is true; but, on the other hand, to obtain a subdued light sufficient for your purpose, you must either put the arc lamp far away or tone it down by shades, and therefore waste it; whereas an incandescent lamp can be toned down, by regulating the current, to any colour you like, and it can be fixed just where it is wanted. One-horse power will give you 1,500 candles in an arc, and only 160 candles in 10 incandescent lamps; but these 10 lamps can be so distributed about your space to be lit, as to illuminate your surface or objects with a better light than the arc.

Curiously enough nothing whatever was done in Paris to improve the illumination of streets. The Avenue de l'Opera, the first street practically lighted by electricity, still remains as it was in 1878; but prior to the opening of the Exhibition, a portion of the Boulevard des Italiens was lit up by four De Mersanne lamps, suspended high up, at wide intervals, over the centre of the road. The effect was very fine, but the lamps were very bad. This is the true way of illuminating streets, and it is to be regretted that such an experiment is not tried in London. Street illumination in England by electricity up to the present time is, as a rule, a questionable success.

The question remains for discussion, Has the electric light been brought within the region of practical domestics? I have no hesitation in saying that it has; but whether it can be brought into economical contrast with gas, experience alone will show. Several houses are already illuminated by its agency; others are in hand, my own amongst the number; and when we next meet to consider this subject, I may be able to answer the question with actual facts.

One word as regards the danger of electric lighting. There is no use blinking our eyes to the fact that electricity can be a dangerous servant in the hands of the careless and ignorant; in the hands of the skilled it has less danger than gas, or even oil. The installation of the wires must be controlled by experience and knowledge. I have more than once called attention to this fact, and my warnings have been received with abuse; but in Paris there were no less than five incipient fires, from the wires coming in contact with each other, in the Exhibition building. *The Times* correspondent in Vienna implies that the frightful disaster to the Ring Theatre was due to this cause. The instances in New York are so numerous that the Board of Fire underwriters have issued the following rules:—

"1. Wires to have 50 per cent. excess of conductivity above the amount calculated as necessary for the number of lights to be supplied by the wire.

"2. Wires to be thoroughly insulated and doubly coated with some approved material.

"3. All wires to be securely fastened by some

approved non-conducting fastening, and to be placed at least 2½ inches for incandescent light, and 8 inches for arc lights, from each other, and 8 inches from all other wires and from all metal or other conducting substance, and to be placed in a manner to be thoroughly and easily inspected by surveyors. When it becomes necessary to carry wires through partitions and floors, they must be secured against contact with metal or other conducting substance in a manner approved by the inspector of the Board.

"4. All arc lights must be protected by glass globes enclosed at the bottom, to effectually prevent sparks or particles of the carbons from falling from the lamps; and in show-windows, mills, and other places where there are materials of an inflammable nature, chimneys with spark arrestors shall be placed at the top of the globe. Open lights positively prohibited. The conducting framework of chandeliers must be insulated and covered the same as wires.

"5. Where electricity is conducted into a building (from sources other than the building in which it is used) a shut-off must be placed at the point of entrance to each building, and the supply turned off when the lights are not in use. Applications for permission to use electric lights must be accompanied with a statement of the number and kind of lamps to be used, the estimate of some known electrician of the quantity of electricity required, and a sample of the wire (at least three feet in length) to be used, with a certificate of said electrician of the carrying capacity of said wire. The applications should also state where the electricity is to be generated, whether the connection will have metallic or ground circuit, and, as far as possible, give full details of the manner in which it is proposed to equip the building."

These rules are very simple, and are necessarily carried out by every qualified electrician, but an additional security is obtained by Mr. Edison, by inserting in every branch wire a "safety catch," which is a short piece of lead wire that instantly melts if the strength of the current exceeds a certain value, and thus ruptures the circuit, stopping the flow of electricity, and producing safety.

The completeness of Mr. Edison's exhibit was certainly the most noteworthy object in the exhibition. Nothing seems to have been forgotten, no detail missed. There we saw not only the boilers, engine, and dynamo-machine, but the pipes to contain the conductors; the conductors themselves, heavy and massive, for Mr. Edison recognises the waste of energy that must occur in small conductors, the insulation, the fixtures, the brackets, the safety catches, the lamps, devices to avoid the effects of expansion and contraction through changes of temperature, meters to measure the current used, regulators to control the consumption of fuel. In a properly regulated system there ought to be no waste of fuel. The engine driver has an indicator which shows him exactly what current is going out, and he has simply to regulate his firing by this indicator. Moreover, by the use of a rheostat, he is also able to regulate the outgoing current so that he is able to maintain a perfect ratio between the fuel consumed and the light evolved

The question that determines the size and insulation of conductors is a commercial one, and is regulated by the relative economy of waste of energy or interest on capital expended. If an expenditure of £100 per mile saves you £10 a year in fuel, it is clearly better to expend £100 on your conductor. If, on the other hand, it would save you only £2 a year, it is better to utilise your capital elsewhere. Every inch of conductor means waste of energy; the shorter and heavier it is the less the waste; but as some waste is imperative, it is simply a matter of calculation to determine which shall be wasted least, capital or fuel.

The system is self-regulating, if the electromotive force is kept constant, and the resistance of the lamps be uniform. We have the dynamo-machine at one end of the circuit, and a lamp at the other. The circuit is complete; a small current flows, which is determined by the resistance of the lamp alone, if the main conductors are made sufficiently large to neglect their resistance. Additions and subtractions of lamps only vary the resistance, and, therefore, the current. Turning off one lamp does not interfere with the rest. The limit of the number of lamps inserted is determined by their resistance, and by the heating of the armature; hence the value of high resistance in the lamps, and low resistance in the armature of the dynamo-machine. Every lamp induces, as it were, its own current. We have not a store of electricity which has to be subdivided, but we generate our energy as we want it. This is the promising feature of the system. It is a principle of multiplication, rather than of sub-division, and leads one to anticipate economy in its working. Mr. Edison's system has been worked out in detail, with a thoroughness and a mastery of the subject that can extract nothing but eulogy from his bitterest opponents. Many unkind things have been said of Mr. Edison and his promises: perhaps no one has been severer in this direction than myself. It is some gratification for me to be able to announce my belief that he has at last solved the problem that he set himself to solve, and to be able to describe to the Society the way in which he has solved it.

It may be taken as a rule, that any system dependent on the exercise of abnormal energy is certain sooner or later to break down; we all of us hate personal supervision, and personal supervision at home is a species of abnormal energy. This is the great secret of the success of gas. It is the cause of the slow progress of the arc light; but it is because the incandescent light promises to rival gas in this respect, that such a future is open to it.

The awards at the Paris Exhibition were liberally bestowed by the jury, perhaps too much so; but matters were hurried up towards the end, owing to political difficulties, and the conclusions were necessarily hasty. No proper measurements or tests were made by any jury, but a committee, presided over by M. Tresca, has since been formed to continue the work, and there is no doubt that most valuable results will be obtained, for the desire of the jury to procure reliable measurements has been very generally met by the exhibitors. I had great hopes of being able to give you the results to-night, but the reports are not yet complete.

We shall all, very soon, have a repetition on a different scale, and in a different way, at the Crystal Palace, and I have little doubt that, in its way, the Crystal Palace Exhibition will be as fine and as interesting as that at Paris.

DISCUSSION.

The CHAIRMAN said he could not open the discussion better than by calling on Mr. Johnson, the representative of Mr. Edison.

Mr. JOHNSON said he did not know that he could supplement what had been so well said by Mr. Preece, so as to add to the interest of the subject, but he should be ready to explain anything which had been left unexplained, and he would also illustrate, further, the use of some of the apparatus. He wished, however, to say that Mr. Edison's system was not merely a system of electric lighting; but the novelty of his system lay in this, that he contemplated the manufacture of electricity on a large scale at a central station, and its universal distribution throughout the entire area of the city where it was established, to be used by uneducated or unscientific people, without the supervision of trained experts in the employment of the company. They proposed to put the electric light into houses in such a simplified form, and with such provisions, as to render supervision entirely unnecessary; to bring the lamps within the care of ordinary house servants, no matter how ignorant they might be; and in such a way that no damage or waste was possible. The electricity thus converted into light might also be converted into power, by means of an electro-motor; and it might be utilised in a variety of ways, such as for ringing bells, &c. The annoyance of maintaining a battery, as well as its expense, had hitherto proved a bar to its general use, but when electricity could be supplied and paid for only as used, to be shown by a meter, an immense deal of work, such as driving sewing machines, &c., would be done by it. There had been a good deal of talk about a regulator, and Mr. Preece had shown that one might be made to maintain an even pressure throughout an entire district lighted from one station, no matter how many lamps were lighted by it. They preferred to have such a regulator with personal supervision, just as gas companies regulated the pressure on their mains as required, rather than employing any automatic device, which was liable to get out of order. [Mr. Johnson here showed how the amount of current could be increased or diminished at will, so that when fewer lights were in use, the quantity would be diminished accordingly.] The man in charge of the central station would regulate the current by a sample lamp kept alight there. He had been asked whether the replacement of the lamps, when used up, was expensive or difficult. In answer to that, he might say that in New York, where they were making arrangements to light up a central district of a mile square, they proposed to supply every consumer with all the lamps he might use, free from cost, simply charging the cost of the lamp in the current supplied and paid for on his meter. The first cost of the lamps was very small to them, and they therefore preferred supplying them to subjecting the consumer to the annoyance of having to purchase them. [Mr. Johnson here unscrewed a lamp, and attached another, to show the readiness with which a change could be effected.] A question had also been asked him, whether a single light could be raised or lowered; and there was a lamp made in which this was provided for, but it was more expensive and complicated, and was not recommended. There were very few cases where such would be required, because you need not leave a light on, as in the case of gas, in order to light up when required, as you only had to turn it on, and it lit itself.

Sir HENRY TYLER, K.C.B., moved a vote of thanks to Mr. Preece, but remarked that the paper hardly answered to the title, inasmuch as it was mainly devoted to an explanation of Mr. Edison's lamps, and he thought there might have been a little more time bestowed upon other lamps. He was far from wishing to disparage the Edison lamp, and no one had more sympathy than he had with American inventors; but he would suggest that the title of the paper should be altered when printed.

Mr. E. CROMPTON said he had been much interested in the paper, but he must concur to some extent in Sir H. Tyler's remarks. Many, if not all, of the merits of the Edison lamp were common to other incandescent lamps. He, therefore, thought

Mr. Swan and Mr. Lane-Fox ought not to be passed over in silence, or Mr. Maxim, the other great American inventor. Mr. Preece had been rather hard on the arc systems, which he said had made comparatively little progress; but in reply to that, he would ask the meeting to look at the length and breadth of England, where, since that time last year, there had been from 900 to 1,000 installations of the electric light, which, with the exception of 30 or 40, were all on the arc system, and, with very few exceptions, they were all working most successfully. The incandescent systems were working equally successfully, but the whole system was an infant compared to the arc, and had not yet been worked on a sufficiently large scale to judge of its merits. It had hitherto been placed in circumstances not best suited for it. The lighting of the Savoy Theatre was a great success, in his opinion, but no one could say that that vast open space could not be lit more satisfactorily with arc lights, if good ones, and properly managed. The arc light hitherto had had to struggle with the great difficulty of getting homogeneous carbons; but new manufacturers were setting to work, and he believed the trade of making these carbons would soon become one of the great industries of the country. It required nothing but the enormous demand, now springing up, to produce splendid carbons, which would give a perfectly satisfactory light.

Mr. J. N. Shoolbred said he had nothing to add to Mr. Preece's description of the Paris Exhibition, but he thought his remarks as to the future sphere of the arc light and the incandescent light respectively should be somewhat modified. He did not think the arc light need be confined merely to large open spaces. It was a question of the enormous difference of mechanical energy; and a case which recently came under his notice would illustrate this. It was the interior of a building considerably larger than that hall, which it was found would require about 6-horse power to light it by the arc system, whilst on the incandescent system it would have taken nearly 40-horse power, and from 170 to 200 lights. With regard to the experiments shown that evening, he must fully concur in what had been said as to the beautifully steady character of the lights, but at the same time, it was only fair that due credit should be given to other inventors.

Mr. Hugh Clements remarked that Mr. Edison had evidently gone beyond anyone else up to the present time, in the manufacture of his 20-ton machine at any rate. Mr. Preece, of course, could not enter fully into the details of all the lights; but he understood him now to withdraw a statement he had made on a former occasion, that it was impossible for private houses to be lit up by electricity from a central station. There was evident proof that this was being done in New York, and he hoped the time would soon come when they would see the same thing in London.

Captain Verney, R.N., said it might be interesting to the meeting to hear the opinion of one of the general public, entirely unconnected with any electrical interest. He had visited the Paris Exhibition twenty or thirty times, and had been many times in both the Edison and Swan rooms. He must say that he came away with the impression that on the whole the Lane-Fox was the most satisfactory exhibit. He was also much impressed with the beauty of the *Lampe Soleil*, which Mr. Preece had alluded to, but not described very minutely. One of its great beauties was, that you could introduce other substances as a bridge between the carbons, and thus vary the colour and quality of the light. The light was exceedingly soft and agreeable, being generally overhead, and it seemed to him an enormous advantage to be able to introduce marble, magnesium, or some other substance, and so tone the light as to be suitable to the place to be illuminated. He hoped those who had the management of the Exhibition at the Crystal Palace, would enable the general public to gather from it more information than was available at Paris. There they were furnished with an incomprehensible catalogue, referring to numbers which did not exist, and to rooms which could not be found. It was a most perplexing thing for anyone with the average amount of intelligence and energy, to learn anything from the Paris Exhibition.

Mr. Lascelles Scott did not propose to launch upon the vexed question with which the discussion opened, further than to suggest that, as Mr. Preece had on former occasions spoken rather adversely to Mr. Edison, he felt constrained now, with more information, to do him full justice. He thought the time was hardly arrived to pronounce definitely that the arc light was only suitable for large open areas, and that the incandescent system was best for internal use, or *vice versa*, because in all probability, in a few years, such an opinion would be very much modified. Judging from his own small experience, he desired to place on record his opinion that probably the domestic lamp of the future would be one in which the prominent features of both systems were combined, which would illuminate a room alternately, or almost at the same time, by either a small arc, or an incandescent lamp. There was already a system which professed to do something of the kind.

The Chairman said he thought the last speaker had really given the answer to the objection raised by Sir H. Tyler, by referring to Mr. Preece's desire to restore the equilibrium of the balance, which, on a former occasion, had been unduly depressed on one side. Passing from this matter, and going to the real subject of the paper, they had before them a remarkable example of the incandescent light, and he thought they must all agree that if this light could be introduced into houses, in the same way as gas, and at no greater, or a very little greater, expense, it would be forthwith adopted. A lamp which did not vitiate the atmosphere in the least, which gave off but a small amount of heat, which was capable of being absolutely extinguished, and then renewed again in a moment, was one which all would willingly take instead of a gas lamp, which certainly did pollute the air, heated it inconveniently, and if there were too much pressure, or the burner were out of order, smoked and spoiled the furniture and pictures. Under these circumstances, he thought it could not be doubted that if they could all, by a mere word, change their gasfittings and lights to such as they saw there, that word would be uttered; but then came the question, how near were they to that being practically and commercially possible. He believed they were very near to it. It had been said, and truly, of the electric light, as one of Dickens's characters said of the steam-engine, that it was yet in its infancy. Sometimes infants grew up well, and became a pleasure to their parents; sometimes they grew up ill; but he believed this infant would turn out a credit to its parents, and that they would soon have the electric light laid on in the manner which had been stated. The difficulties at present attendant on applying it to individual houses, were those connected with the motive power, a large question which he could not then fully go into; but there was a system, somewhat inaccurately called "storage of electricity," by which there might be brought into any house a number of boxes, not storing electricity, but each containing an apparatus which had, by the agency of electricity, been put into a condition competent to develop electricity in an absolutely regular manner, a most needful quality for the satisfactory production of the incandescent light, although he must say no want of steadiness was observable from the working of the engine that evening. You could, therefore, by the aid of these boxes, practically have electricity brought into your house, as you had gazogenes, ready charged, or as he remembered many years ago, portable gas was carted to houses in the city. Unless there were some such system as that, persons who wanted to use the electric light had to resort to a motor of some kind, and there was the choice between steam-engines and gas-engines. A large steam-engine, at present, was more economical than a gas-engine, but on the other hand, it required a more skilled attendant. To work a gas-engine, you had to do little more than turn a tap, and to oil occasionally; the stoker and engine-driver were really at the gas works. The manager there supplied a regular flow and pressure of gas, and in that way the labour of attendance to each engine was reduced to a minimum. In the case of small engines. This non-necessity for skilled attendance reduced the cost practically far below that of a steam-engine. For that reason, he believed, that the individual lighting of houses would be done by gas-engines, and that if you took the gas with which your house was lighted, and applied it to work an engine, you would obtain a greater amount of light from incandescent lamps than by burning the gas direct. The calculation had been gone into very carefully, and were it not for the cost of replacing the lamps, it was quite clear that even now economy was considerably on the side of electricity. He was glad to hear from Mr. Johnson that in America the company preferred to include the replacement of the lamps in the fixed charge for the electricity; but that could hardly be done where each man had to produce his own electric current. A thousand hours was stated to be the average life of these lamps, some being much above and others much below the average. The other day a committee, of which he was a member, did not feel it safe to calculate the average at more than 500 hours, and then putting the cost of renewal at 5s., it turned out that that, added to the fuel, made the electric lighting rather dearer than gas, and they had deferred the consideration of the matter for a few weeks to obtain further information. But if electricity could be laid on to houses, no doubt the problem would be, to a large extent, solved. One of the great difficulties was in the meter, but they had had one of a very ingenious and apparently efficient character exhibited that evening, and that might render practicable the establishment of a company for laying on electricity like gas or water, charging the consumer only for what he used. With regard to another point which had been considered a great difficulty—the division of the current—Mr. Preece said it was not really a divided current, but that each lamp induced its own current. That did not seem to him a very happy mode of expressing it, and he would endeavour to explain it in another way. Each of the lamps they would see, was situated between two parallel wires, from which went two small wires, which were attached to the filament of carbon in the lamp. Now, if instead of electricity they supposed water were being used, and that the wires represented the pipes, and one pipe contained a pressure of water, while the other acted as a return pipe, there being no connection between the two except by small pipes, represented by the wires going to each lamp, as long as only one of these small pipes was opened, the quantity which would pass would be only as much as could be transmitted by the one small connecting pipe; if two were opened, there would be double the quantity, and so on. Assuming for the moment that none of the pipes were open, then having once established a pressure of water, it required no energy to maintain it, if there were no leaks. You could bring the pressure up to a 100 lbs. on the square inch, and if there were no leak, it would continue for ever; but if you established a connection between the pressure pipe and the return pipe, and allowed one gallon per minute to flow away, you must exert as much energy as would supply one gallon per minute under a pressure of 100 lbs. Similarly, if you established a connection between one wire and another, which allowed a given amount of electricity to pass, you must employ as much energy as would develop electricity equal in quantity and tension to that which had passed away; if you had ten wires connected, you must develop ten times as much energy. So that it was not in truth

a sub-division of the current, but was allowing the current to flow, and regulating the amount of power to be put on accordingly. It would be easy to ascertain, by an indicator at the central station, what the demands were, and determine what should be the amount of pressure, as it were, in the conductors, and the number of horse-power required to be developed in the engine, in order to supply the pressure, Mr. Johnson gave as an illustration the governor at a gas works, which controlled the pressure in the mains, and which had to be varied, from time to time, according to the draft upon them. At this time of the year, probably at half-past three, there would be a rise of pressure of so many tenths, another rise at four, again at half-past four, and so on until you got to the time when the theatres and shops were all using gas; and then came the maximum, which would be maintained until ten, when there would be a slight reduction, and a further reduction at midnight, when the uniform night pressure would come on and be maintained until about six; and then perhaps the day pressure would come on, and be maintained until the afternoon. A gas manager plotted this out on a sheet of paper which was affixed to the instrument, and this drew on the same sheet of paper, a trace showing the amounts and the durations of the pressure actually given, by the governors, so that, according to the way in which the pencil followed the lines already laid down, the manager could judge of how his directions had been carried out. Thus, by looking at the paper, you could tell if there had been a foggy day. If the day pressure provided for was say $\frac{13}{10}$, and the implement showed there had been $\frac{20}{10}$, you would know that there had been a fog, that the paper had had to be disregarded, and extra pressure put on. As he understood, provision would be made in the same way for increasing the electric current when required. With respect to the arc and incandescent lights, they would all agree that no one could dogmatise on what would be the light of the future, the whole matter being, as yet, too much in the trial stage; but, at present, he thought all would prefer the incandescent light for domestic illumination. It was admitted that the arc light was much more economical, perhaps 10 to 1; Mr. Shoolbred said 8 to 1. The Mr. Preece objected to the arc light being placed high up; but it was shown conclusively to the committee that sat on the lighting of Liverpool, that there really was no loss by placing the light high up. It was true the effect of the light diminished with the square of the distance, and that, therefore, a light a hundred feet up would give only one-hundredth part of the intensity of light that would be given by the same light if it were ten feet up; but, assuming an equal diverging angle for the really effective rays, it would, on the other hand, light a hundred times the area. The only difference, probably, would be the want of penetrating power in case of fogs.

The vote of thanks having been passed unanimously,

Mr. PREECE, in reply, said it appeared that his sins had been rather of omission than commission, and this would be further explained by the opening paragraphs of his paper. It must also be remembered that that was the third or fourth time he had read a paper before the Society on electric lighting, and the sixth or seventh time he had spoken on the subject, and he had not, of course, again gone over ground he had already trodden. It would not be true to entitle his paper a description of the Edison light, as other matters were treated; but it was evident that what he had said about it, and what had been seen by the audience, had produced a very deep impression on their minds.

1837

1838

ELECTRIC LIGHTING AT THE PARIS EXHIBITION.*

By William Henry Preece, F.R.S.

The recent International Exhibition of Electricity in Paris marks an epoch in the history of the practical applications of that science to arts, manufactures, and commerce. I propose to-night to refer only to its application to artificial illumination; but there are many other branches fully deserving examination and discussion by this society. It was, however, as an exhibition of electric lighting that it was principally attractive, and those who saw it for the first time will never forget the vivid impression that the great blaze of splendour produced upon their minds on entering the building. There never can be anything like it again, for as wisdom grows with experience, so no manager of any future exhibition is likely to repeat that terrific *mélange* of lights that flooded the interior of the Palais de l'Industrie with great brilliancy, but with an impractical and impossible means of comparing and judging the relative merits of different systems.

For instance, at the forthcoming exhibition at the Crystal Palace, the building—splendidly adapted for the purpose—will be divided into sections, each section being lit by one, and only one system. But at Paris, Pelion was piled upon Ossa; the British Section, for instance, received rays from at least a dozen different sources. To estimate the value of a Siemens lamp you had to eliminate the disturbing influence of a blazing Crompton; and to admire the star-like Jasper arc, you had to run the gauntlet of a flock of Swans. The fretful Jamin, or the fitful Jablochkoff, were masked by the steady Gülcher or the brilliant Serrin. In the galleries, however, it was different. Here, different *salles* were illuminated by different systems; a small theatre was lit by the Werderman lamp, and a picture gallery most effectively shown up by the *Lampe Soleil*; a buffet was softly and brightly lit up with the Swan lamp, while Mr. Edison's numerous exhibits, in his own *salons*, were as visible by night as by day, thanks to his own beautiful lamp.

It is not my intention to examine, *seriatim*, the various machines, lamps, and modes of illumination shown. With most of them you are already familiar. But I purpose to select what appeared to me to be novelties, and what seemed worthy of bringing to your notice, as steps in advance.

On the night of August 29th, there were in operation 277 arc lamps, 116 candles, 44 arc incandescent lamps, 1,500 incandescent lamps, or a total of 1,837 electric lights in all, at the Paris Exhibition. Towards the end of the period during which the show was opened this number was very largely increased, and I have little doubt that the number reached 2,500 in the beginning of November. Now this army of lamps required power to convert the energy stored up in coal into energy of motion; dynamo-machines to convert the energy of motion into electrical energy; conductors to transport this electric energy to the point to be illuminated; lamps to convert the electric energy into energy of heat, and therefore of light.

The exhibition of engines and machinery was very extensive, although our English manufacturers failed to do what they might have done had they thought as highly of the exhibition at first as they did afterwards. Many of our manufacturers were conspicuous by their absence. The only extensive display was by Messrs. Robey and Co., of Lincoln, who showed eight of their well-known engines, with a total power of 250 horses, and I have every reason to believe that their success has amply repaid them for their enterprise. Mr. Brotherhood made a small show, and Messrs. Wallis and Stevens, of Basingstoke, sent one of their semi-fixed steam engines, with their pretty and effective governor for adjusting the speed while in motion, uniformity in speed being an essential criterion of an electric-light engine. The foreigners, for a wonder, far outshone the British in the magnitude of their displays.

One of the most valuable exhibits was made by Messrs. Thomson, Sterne, and Co., who showed a new gas-engine on a new principle, which attracted a great deal of attention. Gas is destined to play a most important *rôle* in the future of electric lighting. Its function is that of a heat-generator. The energy of the coal exists in gas in a form which can develop more light, when converted into the form of electricity by the current, than in the form of heat by combustion. Gas-engines have a very high theoretical efficiency, and they are free from the dangers of boilers, the neglect of stokers, or the waste of energy in chimneys.

Gas engines on the "Otto" principle, from half horse-power to fifty horse-power, were very extensively exhibited by France, but the machine of Thomson, Sterne, and Co. (Clark's patent) excelled them all in lightness, compactness, regularity, and safety. One of these engines may now be seen at work at the Smoke Abatement Exhibition at South Kensington, and several have been ordered for private houses. As an adjunct to the gas engine, Mr. Dowson exhibited an interesting and valuable process of making cheap gas for motor purposes. Professor Ayrton reported that in a series of trials made with a three-and-a-half horse-power (nominal) "Otto" engine, driven by the Dowson gas, one horse-power (indicated) was obtained per hour by the consumption of gas derived from 1·46lb. of coal. For larger engines he anticipated a consumption of only 1·2lb. per indicated horse-power per hour. You will have a paper during the Session by Mr. Dowson himself, describing his mode of manufacture. When, perhaps, 6lb. of coal per horse-power per hour are consumed in the present electric light steam engines, you can form some idea of the economy to be effected by cheap gas.

Dynamo machines—machines which convert the energy of motion into electrical energy, through the medium of magnetism—were exhibited in abundance, of all kinds and forms, from the original apparatus of Faraday, made with his own hands, to Mr. Edison's latest development of this wonderful source of electric currents. There are two kinds of machine—the one producing currents from fixed and permanent steel magnets, the other from electro magnets, excited by the currents which they themselves generate. Each kind is also sub-divided into two others, in one of which continuous currents are produced, flowing in one direction, called the continuous current machine; and in the other alternate currents, called the alternate current machine, where the current rapidly reverses and changes its direction. The production of currents by these machines is due to the simple fact discovered by Faraday, that if a conductor, such as a copper wire, be moved rapidly through a magnetised space or a magnetic field, as it is called, this conductor is electrified, so that if its two ends be connected a current flows. The intensity of this current depends, first, on the inten-

sity of the magnetism present, on the velocity with which the conductor moves through the field, and on the direction with which it cuts the lines of magnetic force which permeate the magnetic field. The magneto-electric kind—the manufacture and invention of M. de Meritens—are very much approved of by our Trinity House for lighthouse purposes, and a very fine display of them was made by M. de Meritens, who seemed to live in the Exhibition, for he was always there, and who never seemed to tire of giving his clear and able descriptions. He exhibited alternate and continuous current machines, and he richly deserved the gold medal that was accorded to him. The exhibition of dynamo-machines was rendered very interesting by the exhibition of an early machine of Elias, of Haarlem, of 1842, and of Pacinotti's machine of 1861. The former was shown in the Dutch Section, and the latter in the Italian. Here we have the germs of all the present machines, and by whatever name a machine may be known, it can be traced back to these original types. The Pacinotti apparatus has been very greatly improved by Gramme and by Siemens—forms well known to every one—but it has received its greatest development in the Edison machine, which was one of the wonders of the Exhibition. As this was one of the greatest novelties I must briefly describe it. In the first place, I must must point out that the machine is larger than any one that has ever been made before. It weighs twenty tons, and it can produce a current of electricity of nearly 900 ampères.* Now, when the longest machine of the Gramme type weighed scarcely a ton, and produced a current of but 93 ampères, the difference becomes striking. Now, Mr. Edison has struck out three new paths in the bulk and form of his electro-magnets, two in the size and construction of his armature, and three in the low resistance of his revolving coil. By the first, he secures an intense and concentrated magnetic field, by the second he secures a high cutting velocity for the moving conductor through this field, and by the third he secures a very powerful current to be distributed among a great number of lamps with the least possible waste of energy. The long and bulky coils, 8 feet long, which constitute his electro-magnet, have excited the surprise of many electricians, but there is no doubt that he has arrived at this form after many careful practical experiments, supported by the mathematical investigations of Professor Rowland—a very high authority—and that the result is to obtain an intense field in a large space, with the least absorption of electrical energy in the coils. With 350 revolutions per minute he is able to produce an electromotive force of 110 volts, which an ordinary Gramme machine can only attain with over 1,000 revolutions per minute. His field-magnets are wound with wire, which have a resistance of 30 ohms, and which are connected as a shunt to the main circuit, as was originally done by Wheatstone, and is now followed by Dr. Siemens and Sir William Thomson. The armature is not wound with wire, but is constructed with solid bars of copper ¾in. by ¼in. section, and 3½ft. long, which are well insulated from each other, and are most ingeniously connected at their ends by copper discs, so that all the bars, of which there are 138, form one continuous circuit, whose total resistance is only 0·008 of an ohm. The diameter of the armature is 28 inches. The core of the armature is made up of 1,700 thin iron discs insulated from each other by paper, and well clamped into a solid mass by bolts. This is done to avoid the heating effects due to so-called Foucault currents induced in the metal and absorbing or wasting energy. The iron core of the armature becomes thus magnetised, and it concentrates the field to the space through which the conductor moves, as is done in Siemens's and other machines.

There are two great troubles in existing machines, want of uniformity in their motion and the slipping of belts. The former is met with by governors, and the latter by direct gearing. Steadiness of motion is essential, otherwise we have that painful throbbing of the light that is so irritating to the eyes. Mr. Edison connects his armature direct to his steam motor, which is a high-pressure engine of the Allen-Porter type, governed by an ingenious centrifugal regulator, and rotating very uniformly at 350 revolutions per minute, without any multiplying gear whatever. When the machine is giving out its maximum commercial effect it absorbs 125 horse-power, the external resistance should be 16 times that of the armature—the electromotive force 110 volts, and the current consequently 860 ampères. It is not safe to exceed this limit, for the armature then becomes unduly heated. A special blower is added to direct cold air on the armature to keep down the heat, when the work of the machine approaches its limit. The brush is a special feature of this machine. The absence of sparking was very striking. Mr. Edison coats his brush and commutator with an amalgam of copper, which diminishes the electrical resistance of contact, reduces the heat, and prevents sparking.

Those who are interested in this machine, and everyone should be, for it is a decided step in advance, will soon have an opportunity of seeing it at work at 57, High Holborn.

There was a very interesting form of Gramme machine shown, which was maintained at a velocity of 2,400 revolutions per minute, and was said to generate an electromotive force of 2,000 volts. It maintained 60 Jamin candles alight. But one of the best and most compact forms of Gramme was that shown by the British Electric Light Company, designed by their engineer, and made for them by Messrs. Emerson, in Stockport.

The display of lamps was the display of the building. There were very few novelties among arc lamps. An arc lamp consists of two sticks, or rods of carbon, which are kept apart by a small fraction of an inch while the current flows through them, but which come together when the current ceases. Across the interval separating them there is a steady flow of electricity, accompanied by a slow consumption of the carbon of each rod. This flow of electricity produces high temperature, and intense incandescence and combustion of the carbon particles. This is the arc. One lamp differs from another only in the way in which the carbons are moved forward as they consume, so as to maintain the resistance equal and the light steady. Among arc lamps, that which singled itself out among all its compeers, for steadiness and brilliancy, was the Jasper lamp, exhibited in the Belgian Section; but it had the disadvantage of absorbing all the energy of one machine.

THE EDISON ELECTRIC LIGHT COMPANY.

1838a

The following is a report of the annual meeting of the stockholders of the Edison Electric Light Company, which was held in the last week of October at the company's offices in Fifth-avenue, near Fourteenth-street, New York. The purpose of the meeting was the election of a board of trustees composed of 13 members, and the discussion and adoption of the annual report summarising the transactions of the company for the last year. The report set forth, in opening, the manner in which the indebtedness of the company contracted during the year 1879 was liquidated by authorising the board of trustees to borrow of the stockholders a sum equal to 60 per cent. of their stock, and to issue in consideration of such loan certificates of indebtedness convertible at par into shares of the capital stock. In November, 1880, an increase of the capital stock from 300,000 dollars to 480,000 dollars—the present figure—was duly sanctioned at a special meeting, and the certificates were redeemed by the issue of new shares. The exhibition of the electric light at Menlo Park last winter, which occupied two or three months, was next adverted to as having proved the practicability of the Edison system and demonstrated its economic success. Six hundred lamps were kept lighted for weeks and six miles of mains were laid in the streets of that village. In January last Mr. Edison announced that his system was perfected, and experiments were discontinued. The next step was to test the system on large scale for street and house lighting, and for this purpose a tract in New York city was selected. It was found, however, that the Edison Electric Light Company could not obtain leave to lay mains beneath the streets, and a new company, known as the Edison Electric Illuminating Company, had to be incorporated under the gas statutes of the State before the work of laying the mains could be commenced. This was done last spring, and contracts between the two companies were signed as a condition before proceeding to further action. In the same manner, in June last, it was resolved to form a special company for the development of the electric railway, for whose exhibition Mr. Henry Villard is now building two and a half miles of road at Menlo Park, under a contract entered into in September last. The lighting of railway trains and steamships by electricity has not yet received the full attention of the Company, and no new movements will be made in these directions until the completion of the station in this City, and the lighting of the proposed district have been successfully accomplished. The steamships "Columbia" and "City of Worcester" are now lighted by the Edison system. The business of supplying isolated plant for dwellings and manufactories has developed rapidly under the superintendence of Mr. Moore. The Orange Woollen Mills, Newburg; the Baldwin Locomotive Works, Philadelphia; the factory of Hinds, Ketcham, and Co., New York; the Prospect Park House, at the Adirondacks and the Newburg factories are among the establishments in which the system is in successful operation.

1838b

A Visit to the Paris Exhibition.—A report has been received by the Corporation of Manchester from a sub-committee deputed by them to visit the Electrical Exhibition at Paris and report on the exhibits. The committee were evidently very much impressed by what they saw, though as they do not seem to have included an electrician amongst their number, their report is rather a general one. Electric lighting forms the burden of the report, as might be expected, though Faure's battery takes a prominent position also. We extract the following as being the opinion of ordinary business men on electric lighting. The report says:—"The fact that the powerful companies formed for the manufacture and supply of the various apparatus are at present unable to meet the demand upon them is evidence that electric lighting is rapidly growing in public favour. There is no doubt ample margin in the prices at present charged for some of the lamps and apparatus to allow of a considerable reduction which would still leave a substantial profit. The Edison lamp, for instance, which is sold at 4s., is said to cost 1s. 5½d., while the Swan lamp, a very similar one in construction, was until very recently sold at 25s., and it is clear that at the reduced price of 12s. 6d. there still remains an enormous profit for the inventor. It may be noted, as indicating the position now being assumed by electricity, that one of the leading exhibitors expressed his willingness to undertake its supply at a price not exceeding the price at present charged for gas, the illuminating power to be quite equal to that of gas, and he claimed that he would at the same time realise a large profit."

1839

1842

1843

TRAIN LIGHTING: ELECTRICITY OR GAS?

TO THE EDITOR OF THE ELECTRICIAN.

SIR: Referring to the serious accident on the North London Railway on Saturday last it gives us a warning of the dangers attached to the system of lighting trains by gas, which is stored in bags at the rear of the train. At the time of the accident there was a quantity of gas liberated in the tunnel, which gas, fortunately for everybody, merely managed to get away; had it exploded (it is a mercy it did not) the results would have been shocking, and very few of the passengers would have escaped. Considering the perfection we have now arrived at with the electric light on the incandescent system, which gives us a beautiful light free from danger and obnoxious fumes—under these conditions it seems strange the railway companies do not appear to be at all anxious to adopt this method of lighting. What could be more simple than having a small dynamo machine fixed in the break van, worked by a band or other suitable means from the axle of the train, a few secondary batteries or accumulators, which would regulate the light when running and supply the lights when stoppages were made. The guard would, after a few lessons, attend to the machine and batteries as easily as he now attends to his oil lamps; the cost after the first outlay would be less than oil and lamp men, and the benefit derived from this source of lighting would be beneficial and appreciated by all.—Yours, &c.,

28, Culford-road, N., Dec. 12, 1881. W. A. KENT.

1840

1841

1848

Umschau auf technischem Gebiete.

(Der elektrische Gartenbau in Paris. — Elektrische Be-
leuchtung der Theater zur Abwendung der Feuersgefahr. —
Die Farbe und die Kosten des elektrischen Lichts. — Die
Beleuchtung der deutschen Küsten. — Feuergefährlichkeit
der Telephonleitung. — Die Schiffseisenbahn. —
Wasserversorgung Berlins. — Vergiftung der Gewehrkugeln.)

Wir berichteten seiner Zeit, daß ein französischer Gelehrter
Namens Deherain, durch die Versuche des Dr. William Siemens
in London angeregt, es unternommen hatte, während der Elektri-
citäts-Ausstellung, unter Benutzung des im Gebäude im Ueber-
fluß vorhandenen elektrischen Lichts, seinerseits über den Einfluß
dieses Lichts auf das Wachsthum der Pflanzen, den sogenannten
elektrischen Gartenbau, Experimente anzustellen. Er errichtete
zu diesem Zweck im Ausstellungspalaste ein Treibhaus, welches (e)
mit allerlei Gewächsen anfüllte, an denen er seine Künste ver-
suchte.

Der Bericht über diese Versuche ist nunmehr erschienen, und
lautet wenig ermuthigend, womit durchaus nicht gesagt werden
soll, daß Dr. Siemens sein Referat über die in England vor-
genommenen Experimente zu rosig gefärbt habe. Die Schuld des
theilweisen Mißlingens der Pariser Versuche dürfte einmal an den Ver-
hältnissen, sodann aber auch zum guten Theil an Herrn Deherain selber
liegen. Einmal hatte er offenbar im Anfang, wohl wegen seiner
Unkenntniß der englischen Sprache, keine Ahnung davon, daß nach
Siemens' Beobachtungen das nackte elektrische Licht den Pflanzen
schade und daß es unbedingt erforderlich sei, die nachtheiligen
violetten Strahlen durch Dazwischenschieben einer weißen Glas-
scheibe zu absorbiren. Erst gegen den Schluß, als es zu spät war,
machte er es dem deutschen Forscher nach. Sodann hatte er nicht
genügend beobachtet, daß die Gewächse im Ausstellungsgebäude den
directen Sonnenstrahlen nicht ausgesetzt, ja ganz ungenügend be-
leuchtet seien. Endlich hat der furchtbare Staub im Gebäude seine
Pflanzen zum Theil zu Grunde gerichtet.

Indessen ganz werthlos sind die gewonnenen Resultate nicht.
Herr Deherain hat von Neuem bestätigt gefunden, daß die fort-
dauernde Beleuchtung den Gewächsen nicht nur nicht schade, son-
dern förderfam sei, daß die Pflanzen somit der Nachtruhe nicht
bedürfen und daß deren Thätigkeit den Tag über von der
Thätigkeit in der Nacht nicht differire; daß aber der Gedanke
des elektrischen Gartenbaues jemals eine praktische Gestalt an-
nehmen könne, daß derselbe sich jemals verlohnen würde,
bestreitet er entschieden. Die günstigen Resultate des Dr. Siemens
erklärt er damit, daß dieser seine Pflanzen in einem wohl organi-
sirten Treibhause aufgestellt hatte, wo sie dem Sonnenlicht aus-
gesetzt waren und in einer angemessenen Temperatur lebten. Darin
hat er vollkommen Recht. Dr. Siemens hat auch niemals be-
hauptet, daß der elektrische Gartenbau unter allen Umständen an-
wendbar sei, und stets betont, er eigne sich nur zur Zucht von
Primeurs, wobei selbstverständlich die sonstigen Verhältnisse günstig
liegen müssen.

Herr Deherain hält übrigens dafür, daß die von uns be-
sprochene Sonnenlampe von Clerc und Bureau, bei welcher das
Licht aus einem elektrisch glühend gemachten Marmorblock strömt,
sich für den elektrischen Gartenbau am besten eigene, weil sie ein
an gelben Strahlen reiches Licht von sich giebt.

Angesichts der entsetzlichen Katastrophe in Wien, welche
dadurch entstand, daß Gas, Spiritus und Petroleum, allen War-
nungen zum Trotz, auf der Bühne noch immer nicht ebenso streng
verpönt sind, wie in der Pulverkammer eines Kriegsschiffes, erscheint
es angebracht, von Neuem daran zu erinnern, daß das elektrische
Licht allein die Feuersgefahr bei Theatern zu beseitigen vermag.
Der Einwand, der neuerdings gegen diese Lichtquelle erhoben
wurde, daß sie nämlich zu grell sei, erscheint nicht stichhaltig.
Jedes Licht läßt sich mildern und es beabsichtigen auch die An-
hänger der elektrischen Beleuchtung der Schauspielhäuser damit keine
Erhöhung des Lichteffects, sondern einzig und allein die Verbesse-
rung der Luft, die Beseitigung der Hitze und vor allen Dingen
der Feuersgefahr. Elektrisches Licht brennt in völlig abge-
schlossenen Behältern und braucht nicht angezündet zu werden.
Die einzigen Vorsichtsmaßregeln, die dabei zu beobachten sind, be-
stehen in der guten Isolirung der Leitungsdrähte und in einer
geeigneten Vorrichtung, die es verhindert, daß die Drähte ins
Glühen gerathen, wenn der Strom sich in Folge des Auslöschens
einer Reihe von Lampen irgendwo gewissermaßen staut. Eine solche
Vorrichtung ist ja auch von Edison erfunden; sonst aber genügt
ein telegraphisches Signal nach dem Gebäude, wo sich der Motor
und die dynamo-elektrische Maschine befinden. Daß dieser Motor
(Gas- oder Dampfmaschine) in beliebiger Entfernung von dem zu
beleuchtenden Gebäude stehen kann, wissen unsere Leser. Von dieser
Seite kann somit Theatergebäuden keine Gefahr drohen.

Die Tribune December 19 188

Hieran möchten wir einige Worte über die Vorträge der
Herren Dr. Werner Siemens und Prof. Vogel in der letzten
Sitzung des Vereins zur Beförderung des Gewerbefleißes an-
knüpfen. Ersterer trat der Ansicht entgegen, als sei das elektrische
Licht an sich bläulich. Dies sei nur eine Augentäuschung; dieses
Licht ist vielmehr dem Sonnenlicht gegenüber gelb. Die an-
scheinend bläuliche Färbung komme daher, daß „wir gewohnt sind,
die Welt nach Sonnenuntergang roth beleuchtet zu sehen; das Gas-
licht ist eben roth, und wenn man an eine allgemeine rothe
Färbung gewöhnt ist, sieht das gelbe Licht schon bläulich aus.
Das Mondlicht, welches auch einen bräunlich-gelben Ton hat, sieht
uns ebenfalls vermöge dieser Sinnestäuschung bläulich aus.“ Die
elektrische Ausstellung habe dies übrigens bewiesen. Hatte man
sich im Gebäude einige Zeit aufgehalten, so nahm man die bläu-
liche Färbung nicht mehr wahr, und beim Heraustreten kamen
Einem die Gaslaternen abscheulich braunroth vor.

Professor Vogel verbreitete sich über die Vorzüge der kleinen
Schwan'schen Glühlichtlampe, die er für vorzüglich geeignet zur
Beleuchtung von Privatzimmern hält, sodann über die Bedeutung
der Reflectoren. Er hält es namentlich bei Schaufenstern für
besser, nur reflectirtes elektrisches Licht zu verwenden, wie sie von
den Photographen zu Aufnahmen bei elektrischem Licht benutzt
werden, und motivirt es damit, daß Reflectoren das Licht sammeln
und sogar verstärken. Dies kann man ja übrigens bei den Loco-
motivlampen wahrnehmen, die an sich nur eine mäßige Helligkeit
verbreiten, durch die Reflectoren aber zu mächtigen Lichtquellen
werden.

Hinsichtlich der Kosten des elektrischen Lichts bemerkte Prof.
Vogel, die Behauptung Fontaine's, dasselbe koste 6½ Mal weniger
als Gas, sei nur dann begründet, wenn die ganze Strammkraft
einer Maschine, wie bei Leuchtthürmen, eine einzige Lampe speise.
Sobald aber, wie meist, diese Kraft vertheilt werden müsse, nimmt
die Lichstärke bedeutend ab. „Vertheilt man,“ sagte er, „den
Strom, der in einer einzigen Lampe 4000 Kerzen liefert, auf vier
Lampen, so liefert jede eine Lichtstärke von nur ungefähr 200 Kerzen,
alle vier zusammen also 800, also nur ⅕ des angegebenen Licht-
effects.“ In München z. B. stellt sich das elektrische Licht nur
1,8 billiger als Gaslicht.

Im Verein deutscher Maschinen-Ingenieure berichtete kürzlich der
Vorsitzende, Herr Veitmeyer, dessen Autorität im Fache der
Küsten-Beleuchtung eine unbestrittene ist, über die elektrische
Beleuchtung der französischen Leuchtthürme und über die Frage, ob
wir diesem Vorgange folgen sollen. Die Vortheile der neuen
Methode liegen in der um das Zehnfache gesteigerten theoretischen
Lichtwirkung. In der Praxis liege aber die Sache, namentlich bei
Nebelwetter, anders, da dem elektrischen Lichte der größere Theil
der rothen Strahlen fehlt, welche gerade Nebel am weitesten durch-
dringen. Deshalb erscheine auch an nebeligen Tagen die Sonne
als eine rothe Scheibe. Man wende aus diesem Grunde neuerdings
in England bei Leuchtthürmen lieber sehr starke Gasbrenner an.
Auch sei dem elektrischen Lichte vorzuwerfen, daß es bei klarer Luft
zu hell erscheine und man die Entfernungen nicht mehr schätzen
könne. Der Vortragende hält nicht dafür, daß letzteres Licht sich
für unsere Küsten eigne, zumal die Kosten für die Umwandelung
der Beleuchtungsapparate sehr bedeutende seien.

Der bekannte französische Elektriker Lartigue bestreitet
neuerdings ganz entschieden, daß richtig angelegte Tele-
graphenleitungen jemals feuergefährlich werden
können. In Amerika sind allerdings bereits bedeutende Brände dadurch
entstanden, daß solche Leitungen z. B. mit Täfelwerk in Wohn-
räumen in Berührung kamen. Das liegt aber nur an der lieder-
lichen Anlage, wie sie in Amerika gang und gäbe ist, an der
mangelhaften Isolirung der Drähte, so wie daran, daß sie von
den Leitungen für das electrische Licht nicht genügend getrennt sind.
In Deutschland, wo die Anlage von der Reichstelegraphenverwaltung
ausgeführt wird, ist auch nicht der geringste Unfall vorgekommen.

Zum Schluß dieses Capitels die Nachricht, daß sich in New
York unter der Firma American electric railway and power
Company eine Gesellschaft mit dem bescheidenen Capital von
40 Millionen Mark gebildet hat, welche namentlich elektrische Bahnen
anlegen will. Auch in London wird der Bau einer elektrischen
Hochbahn von einer Gesellschaft unternommen. Hier hingegen über-
lassen wir es dem genialen Erfinder des neuen Beförderungsmittels,
Dr. Siemens, die Kastanien aus dem Feuer zu holen und legen
ihm gar Hindernisse (Berliner Hochbahnen) in den Weg.

Nach neueren Nachrichten aus Amerika hat Capitän Eads sein
Project der Erbauung einer Schiffseisenbahn über die Landenge von
Tehuantepec um so weniger aufgegeben, als es in den Vereinigten
Staaten eine mächtige Unterstützung findet. Man hofft dadurch
dem verhaßten Panamakanal ein Paroli zu bieten und nebenbei
die Annectirung der mexikanischen Republik in die Wege zu leiten.
Das Project selbst hat Eads aber inzwischen erheblich modificirt.
Zunächst will er eine kurze Probebahn herstellen und daran
Experimente veranstalten, ob der Schienentransport nicht etwa den
Schiffen schadet, was er übrigens a priori bestreitet. Sodann will
er durch Benutzung des schiffbaren Flusses Coatzacoalcos die Bahn
um 25 englische Meilen abkürzen. Fernere Vorbesserungen betreffen
die Anwendung von hydraulischen Pressen zur Hebung der Schiffe
aus dem Wasser und von Gummipuffern zur Ausgleichung der von
den Schienen verursachten Stöße. Endlich reducirt er die Anzahl
der Schienen von 12 auf 8. Einen heiklen Punkt bilden die
Stellen der Bahn, wo die Steigungen beginnen resp. aufhören.
Da aber die Verbiegung höchstens einen Zoll betragen könnte, so
glaubt Eads, daß dies nicht viel auf sich habe. Die Bahn wird
für Schiffe von 6000 Tonnen Gewicht eingerichtet. Ueber das
Project haben sich erste Autoritäten im Schiffsbau, wie Sir Edw.
Reed und Sir Bramwell neuerdings recht günstig ausgesprochen.

Im Berliner Bezirksverein deutscher Ingenieure hielt Herr
[illegible] einen Vortrag über die Wasserversorgung Berlins.

1853

1856

1857

LA REPUBLIQUE FRANÇAISE DU 21 DECEMBRE 1881

1854

INCENDIE DU RING-THEATER A VIENNE

Vienne, 19 décembre.

Le vice-bourgmestre M. Uhl a fait aujourd'hui un rapport oral à l'empereur, concernant la catastrophe du Ring-Theater.

L'empereur s'est ensuite rendu à l'Opéra, où l'on avait éclairé la salle comme pour une représentation. Il s'est rendu soigneusement compte de toutes les mesures prises dans ce théâtre pour prévenir les incendies, et a visité toutes les parties de l'édifice jusqu'à la dernière galerie.

Il a ordonné différentes mesures qui n'avaient pas encore été prises et a fait éteindre complètement le gaz pour juger de l'effet de l'éclairage produit par les lampes à l'huile.

L'empereur est resté une heure et demie à l'Opéra.

C'est décidément le 30 décembre prochain qu'aura lieu, dans les salons du second étage de l'hôtel Continental, splendidement décorés pour la circonstance, la soirée, suivie de bal, organisée par la presse française en faveur des victimes de l'incendie du Ring-Theater de Vienne.

Nous pouvons dire dès aujourd'hui que le comité n'a rien négligé pour rendre cette fête aussi artistiquement curieuse et aussi brillante que possible.

Le grand attrait de la soirée sera un intermède musical et dramatique, pour lequel les artistes les plus distingués donneront leur concours. On peut s'attendre à de véritables surprises. Trois orchestres, parmi lesquels celui de la garde républicaine, seront installés dans les différents salons. — Un souper sera offert à tous les invités.

Le prix d'entrée sera de 25 francs.

1855

1869

1860

ÉCLAIRAGE ÉLECTRIQUE

PAR LES

PROCÉDÉS EDISON

Le système Edison se distingue de toutes les autres tentatives analogues en ce qu'il ne consiste pas seulement dans l'emploi d'une lampe, ou source de lumière, bien supérieure aux autres types du même genre, mais encore en ce que tous les détails accessoires ont été inventés et appliqués avec le plus grand succès.

La production d'électricité, sa régulation, sa canalisation, sa distribution et sa mesure, enfin toutes les conditions pratiques de son emploi ont été étudiées et résolues à l'aide d'une série complète d'appareils qui ont tous reçu la sanction de la pratique.

LAMPE

La lampe se compose d'un filament renfermé dans un globe de verre où l'on a fait le vide, et que le passage du courant porte à l'incandescence.

On a essayé de faire ce fil en diverses matières, platine et métaux analogues, charbon de papier, de coton, etc., etc. On s'est arrêté au charbon de bambou qui présente les plus grands avantages comme durée et comme régularité. Ce charbon est relié au circuit par deux conducteurs qui traversent la paroi du verre, et viennent aboutir à deux viroles de cuivre emprisonnées dans une base en plâtre.

L'une de ces viroles est filetée et s'engage dans le support de la lampe en la vissant. L'autre vient s'appuyer fortement, par le jeu même de la vis, sur une contre-virole. Les connections sont ainsi réalisées de la manière la plus simple et la plus sûre.

La lampe dégage très peu de chaleur : on peut la mettre dans la main ou dans la poche, sans être incommodé par sa chaleur. C'est donc bien une source de lumière et non de chaleur, comme l'est surtout le gaz. Elle conserve donc à l'air sa fraîcheur et en même temps sa pureté, puisqu'elle ne lui emprunte aucun de ses éléments comme agent de combustion.

Pour répondre aux différents besoins de la pratique, on construit des lampes de deux modèles.

— Le modèle A, qui donne une lumière de 2 Carcels ou 18 bougies anglaises.

— Le modèle B, qui donne seulement 1 Carcel ou 9 bougies.

Ils ne diffèrent que par la longueur du charbon qui est moitié moindre pour les lampes B que pour les lampes A.

L'emploi de ces modèles doit se faire judicieusement, et en s'en rapportant aux indications fournies par la Société.

MACHINES DYNAMO-ÉLECTRIQUES

Les machines se composent uniformément d'une bobine de fils isolés tournant entre les pôles d'un fort électro-aimant. Celui-ci est parcouru par une partie du courant engendré, qui passe aussi par un rhéostat formé d'une série de bobines de fil de cuivre. En faisant varier le nombre de ces bobines, on agit de manière à régler le courant en proportion avec le nombre des lampes allumées, de manière à maintenir absolument constante le pouvoir lumineux des lampes.

Pour les installations qui comportent un très grand nombre de lampes, comme pour une ville ou un grand édifice, ce réglage est fait avec le secours des appareils les plus perfectionnés de mesure électrique, et ne laisse absolument rien à désirer.

Les courants engendrés dans la bobine, aboutissent à un collecteur, où deux brosses, ou balais de fils métalliques, la recueillent. De ces brosses partent les fils qui vont conduire l'électricité partout où elle est nécessaire.

Ces machines se commandent par des courroies, de la même manière que n'importe quelle machine-outil. La vitesse est indiquée par la Société, et on doit s'y

conformer rigoureusement sous peine de dépenser trop d'électricité, ou bien de n'avoir pas une lumière suffisante dans les lampes.

Pour les plus gros modèles, on attelle directement la bobine après un moteur à vapeur qui n'a pas d'autre fonction que de produire l'électricité. C'est la seule disposition qu'on doive employer pour les usines centrales destinées à desservir un quartier ou un très grand établissement consommant beaucoup de lumière.

La conduite des machines dynamo ne présente pas d'autre difficulté que de maintenir bien graissées les parties de l'arbre de la bobine.

On devra éviter d'approcher de la partie tournante des outils de fer, qui pourraient être attirées par le magnétisme de l'électro-aimant et venir détériorer la bobine ou le collecteur. Les brosses devront être modérément serrées sur le collecteur : si l'on apercevait de trop fortes étincelles, il faudrait les resserrer et les ravancer un peu si elles étaient usées. Il ne faut pas y mettre d'huile ni d'autres matières lubréfiantes, qui auraient pour effet d'empêcher le passage du courant électrique.

Ces machines sont construites de manière à consommer par elles-mêmes le moins possible de courant; de plus, leur production est très sensiblement proportionnelle à la dépense qui s'effectue dans le circuit. On ne doit donc pas craindre de se servir d'une machine de 100 lumières pour n'en allumer que 50 : si la force exigée était de 10 chevaux pour

100 lampes, elle se réduira d'elle-même à 5 chevaux environ pour les 50 lampes.

C'est là un avantage très précieux qu'on ne saurait trop apprécier dans la pratique, et qui est tout à fait particulier au système Edison.

CONDUCTEURS

Le courant est dirigé par des conducteurs de cuivre vers les points où doit se faire son utilisation Ces conducteurs sont naturellement d'une grosseur proportionnée à l'intensité du courant qui les traverse.

Les conducteurs principaux du système Edison sont formés de deux barres demi-rondes de cuivre rouge, noyées dans une matière isolante. Le tout est contenu dans un tube de fer qui est lui-même enveloppé dans un ruban goudronné, afin de le protéger contre l'humidité du sol.

La réunion des conducteurs et les bifurcations sont effectuées à l'aide de boîtes de jonction et de bifurcation spéciales, qui assurent le montage et le remplacement facile.

Les prises de courant ou bifurcations se font d'après le principe de la *dérivation*.

On se le représentera en imaginant que chaque barre de cuivre se divise en deux parties, dont l'une se dirige à droite pendant que l'autre continue son chemin. Chacune des deux parties a naturellement

une section moindre que celle du conducteur primitif, mais la somme doit être égale à la section primitive.

Les boîtes de bifurcation portent une disposition spéciale, dite *fil de sûreté*. Cette disposition consiste à intercaler dans le circuit de la dérivation un fil de plomb de dimension calculée. Le plomb est un métal beaucoup moins conducteur que le cuivre et beaucoup plus fusible. Il arrive alors ce fait : que si deux fils viennent à se toucher directement, le courant se trouve fermé sans avoir à vaincre la résistance des lampes. Cela produit un grand excès d'électricité qui afflue dans la partie du circuit où s'est produit cet accident.

Il en résulte un grand échauffement du conducteur. Mais la partie plomb s'échauffant beaucoup plus vite que le cuivre, le métal fond en ce point, et le courant se trouve coupé. On évite ainsi les suites de l'accident, et on l'empêche d'influer sur les autres branches du circuit. Quand on a remédié au défaut qui existait dans la canalisation, il suffit de replacer un autre fil de sûreté, et on peut remettre le branchement en service.

Ce dispositif se répète à toutes les bifurcations secondaires afin que l'accident n'entraîne l'extinction que du nombre de lampes strictement nécessaire.

COMPTEUR

Pour le service public, il est essentiel de pouvoir mesurer la quantité d'électricité qui circule dans une partie donnée de la canalisation. On se sert donc d'un compteur spécial. Sur un des fils, on prend une dérivation qui traverse une dissolution de sulfate de cuivre par deux anodes en cuivre rouge. Le courant enlève le cuivre d'une des plaques et le transporte sur l'autre : la quantité de cuivre ainsi déplacée est proportionnelle à la quantité d'électricité consommée. Il suffit donc de peser l'une des plaques tous les huit jours par exemple pour connaître cette quantité.

Le compteur est formé d'une sorte de petite armoire de fonte qui contient deux appareils de ce genre. L'un sert aux mesures hebdomadaires : l'autre sert de contrôle et se vérifie seulement tous les trois mois par exemple.

La partie inférieure contient une lampe, qui peut entrer dans le circuit par le jeu automatique d'une lame bi-métallique formant thermomètre. La chaleur dégagée par cette lampe, qui ne s'allume que dans le voisinage de 0° centigrade, suffit à entretenir les bains du compteur en bon état de fonctionnement pendant les froids. Cet appareil est très simple en même temps que très exact.

APPAREILLAGE

On peut varier à l'infini les formes des appareils destinés à recevoir les lampes Edison. On en fait des lustres, des appliques, simples ou à genouillères sans aucune difficulté. Les lampes pouvant être mises dans toutes les positions, on les placera en vue de la meilleure utilisation de la lumière.

L'allumage et l'extinction se font par la simple manœuvre d'une clef, bien entendu sans aucune allumette ni lance à feu.

La manœuvre de tout un groupe de lampes peut s'effectuer à distance en commandant le circuit principal qui dessert ce groupe par une clef ou interrupteur spécial Tous ces appareils accessoires, ont été étudiés dans le détail, et sont aujourd'hui éprouvés par un long usage. Il n'y a donc aucune difficulté dans leur emploi.

CONCLUSIONS

Il est à peine nécessaire, en terminant cette courte étude, de faire valoir les avantages considérables de ce système sur tous les modes d'employés jusqu'ici.

Il ne donne que de la lumière, pas de chaleur. Aucun danger d'incendie ne peut résulter de son emploi. La pose des appareils est simple, et les foyers sont complètement indépendants. La fixité est absolue et la couleur de la lumière est chaude et agréable à l'œil.

Enfin le prix, variable selon les conditions d'installation, est dès aujourd'hui si réduit que la lumière Edison est à la fois, la plus agréable et la plus économique.

PARIS. — IMPRIMERIE CHAIX, 20, RUE BERGÈRE. — 2058-2.

The New-York Semi-Weekly Times, Tuesday, December 27, 1881.

THEMES OF PARISIAN TALK

ELECTRIC LIGHTS FOR THE CITY AND AN ODD WILL CASE.

1902

PARIS, Dec. 9.—I know that to talk about the International Exhibition of Electricity a fortnight and more after its termination, is something like writing on the private life of Romulus and Remus. I intended to have done so earlier, feeling sure that Americans would be interested to learn how the French appreciate American contributions to the show, but I waited for the announcement of the rewards which the Government had accorded to the laureates, which would be a seal set to the merits of those who have been distinguished by the jury. Certainly the Government means to reward, yet great bodies proverbially are slow of movement, and, although the President of the exhibition, Senator Teisserenc de Bort, has moved that special authority shall be granted to distribute extra ribbons of the Legion of Honor to the most worthy, which request will certainly be complied with, the Chambers have been too busy otherwise to give their vote on the matter, especially as the Grand Chancellor of the Order, Gen. Faidherbe, positively declines to bestow the insignia, as well as the diploma, on any foreign nominee, which had hitherto been the custom. This difficulty, however, is not serious, as the French gentlemen connected with the Committee of Organization have signified their entire willingness to defray all the expenses incident upon this act of gracious courtesy, so that I hope in a few days to be able to communicate the full list of new-made knights, on which will appear the names of several of our fellow-citizens. Thus premising as an excuse, behold a statement of impressions made. There was a slight disappointment about the exhibits of Mr. Edison. So much had been said about this inventor, so much published concerning the extent and variety of his discoveries, that more was expected of him than of any other, and expectation was not all realized. The two rooms occupied by Mr. Edison contained relatively few objects either interesting or novel; they were almost entirely filled with apparatus or parts of apparatus destined to the production and diffusion of light. Not a word, except in praise, was said on the subject of the Brush system, whose lamps were among those constructed on the arc principle, which were the most appreciated by experts, who qualified the simplicity and solidity of his installation as "eminently practical and American." Nor were the great merits of Mr. Graham Bell undervalued, although he did not present anything particularly new; it is true that it is not easy for him to improve upon his telephone. The exposition of Mr. Elisha Gray attracted much notice, mainly with his harmonic telegraph, which not only struck the attention of the *profanum vulgus*, but so impressed the specialists that, it is said, the Minister of the Postal and Telegraphic Department has ordered its immediate examination by the engineers attached to his administration, with a view to its introduction into the Government service. As a rule, the public manifested infinitely more interest and curiosity toward the close of the show than I thought would be the case at its commencement, and during the last few days, especially after the illumination had begun, it was almost impossible to elbow your way through the immense building.

Much of the success is attributed to the excellent distribution of the exhibits, and in this matter Mr. Levi P. Morton, Mr. George Walker, our Consul-General; Prof. Barker, and other members of the committee gave to the French a most favorable notion of the faculty for organization of Americans, as well as of their own courteousness, a quality, I am obliged to state, not usually found among official personages either representing our own or other nations, and for that reason all the more highly estimated. Messrs. Heap, Goodwin, and particularly Mr. Philip Walker, were indefatigable, and the American delegates to the congress took an active part in its discussions. In short, I may safely say that every one did his duty and did it well, the task of each one having been greatly facilitated by the presence on the Committee of Organization of Dr. Cornelius Herz, who, I must add, was the only foreigner admitted among the members, by the French Government, and thus effectively represented the interests of two nations. ...

But if the Doctor's case is unique, the Doctor himself is *sui generis*; your readers may remember that I spoke of him on several former occasions in connection with the Werdermann lamp, which he has sold to the Jablochkoff Company for three millions; it is he who now disposes of the destinies of the Lampe Soleil; he was the discoverer of M. Marcel Deprez, whose rare genius might have remained a long time in the background if he had not fallen in with some one who does not believe that lights should be hidden under bushels, and, finally, it is thanks to the initiative of our countryman that there was any exhibition of electricity at all. As I gave an exhaustive notice of the Deprez invention in November, I shall not do more than refer to him *en passant* now—those who are interested in it as scientists can consult the *Lumière Electrique* of the 24 of December; they will find in that organ of Count du Moncel, algebraical and geometrical demonstrations of his theory which must convince the most scientifically skeptical of its accuracy. This week there are to be some further experiments made on the transport of force over long distances—from 100 to 500 kilomètres are spoken of—after which, for I have no doubt of their success, the application of the Marcel Deprez discovery passes into the hands of a company with a capital of two hundred millions to be constituted, under the auspices of the Union Générale, that remarkable bank which has ruined more "bears" than any speculative security on record.

The Union only counts about two years' existence, and yet never has there been witnessed such a struggle between those who tried to "bear" and those who succeeded in "bulling" its shares. Its inventor, M. Bontoux, is, probably, the cleverest financier now living; how he has managed to do it I cannot tell, but he has beaten his adversaries as no one thought it possible to beat such men as Camondo, Stern, Voss, and others who used to rule the Stock Exchange, and has forced the combination of Israelite and Levantine bankers, the so-called "Syndicate of the Five Iron-clads" to ask for terms. The most unscrupulous manœuvres were resorted to in order to ruin the Union. False reports were circulated in the provinces and thence telegraphed to Paris so as to produce a panic; the most fabulous prices were asked for "carrying over;" the margin or *couverture* demanded by some of the agents de change or licensed stock brokers, who are ministerial officers, limited in number to 60, was out of all proportion with custom which rarely exceeds for any security admitted at the Bourse 10 per cent. The machinations were disgraceful, and so disgraceful that, if their intended victim had chosen to prosecute for slander, some of the chief movers would have been sentenced not only to heavy damages, but also, perhaps, to a spell of prison life. But M. Bontoux simply disdained to notice their attacks; he attended to the business of his institution, of which the scrip has risen from 1,200 nominal—in reality 825, as only 125f. of the original 500f. were ever paid up—to 3,000, between the 11th of June and the 23d of November, and now stands at 2,600 fully paid up by the bank itself to its stockholders from the profits of this year's operation, which amount to 75,000,000f. It is this establishment which has taken up the Marcel Deprez system, and about the 1st of January a company with a real capital of 200,000,000f. proposes to introduce electricity into society; to supply to every Parisian such a quantity of the fluid as he may subscribe for, and which he may use either as an illuminating or as a motive agent.

How far this enterprise is likely to be patronized, how much the system on which it is based is considered superior to all others, your readers may judge from two facts: A well-known capitalist, whose name I withhold for the present, met with a refusal to his offered investment of 2,000,000f. last week. Baron Rinach, who was one of the intending promoters of a company which was to work the Edison arrangement, has declined to remain in the affair, in consequence of the proposed formation on the Marcel Deprez system, which possesses the advantage of an immense economy, if it possesses no other. Mr. Edison's system, like all other incandescent systems, generates quantity currents, which are conveyed with copper rods of considerable diameter, and necessarily, on account of the cost of copper, only to short distances. Marcel Deprez uses the ordinary telegraph wire.

I thought to be able to give the judgment of the First Chamber of the Seine tribunal in a curious suit about the will of Vicomte Edgard de Brimont, who left three millions to an adopted daughter, to the disappointment of his family, by whom the testator is accused of yielding to the undue influence of ... Undue influence in the making of wills is becoming quite a favorite allegation nowadays on the part of people not mentioned in them; it is not more than a month since M. Armand Adam's appeal on this ground from the decision of an inferior court was rejected. Armand tried to plead that his brother Edmond was under undue influence, because he left his fortune to his wife, the distinguished "Juliette Lamber," instead of to him, and now the Brimont family propose to make an attempt in the same way in the case of their deceased relative's last dispositions. It was not that the judgment would have been peculiarly interesting, but the trial must have been fertile in strange stories. But the first Chamber declared itself incompetent to act and sent the parties interested to Rheims, so that I can only speak of some of its antecedent incidents. I do not say that Vicomte Edgard was crazy, but Vicomte Edgard was most certainly queer. A member of the Jockey Club at one time, Deputy from Rheims, he has been for many years separated, judicially, from his wife, the still beautiful Mina Shepherd, who, a twelvemonth or so ago, was accused, with M. Edmond Adam, M. Emile de Girardin, and Mme. Armand de l'Ariège, by Mme. Graux, of being a German spy. M. de Brimont was most decidedly eccentric. Since his separation, granted on the demand of the Vicomtesse, whose wedded life was a continued martyrdom, he has led a fantastic existence, made up of the most exaggerated piety and of the most exaggerated depravity. He was a species of high priest of a certain disreputable creed. Always accompanied by some one, he made pilgrimages to Lourdes, insisted on the rigid observance of fasts and abstinences in his household, covered women with jewelry, although refusing them a centime of money; turned friends out of doors without hesitation, and advertised for new ones through the daily papers. Both at Rheims and at Enghein, where he died, a woman named Caroline Sibault was his housekeeper. As he grew old, M. de Brimont having no children of his own, determined to adopt one. His choice was a child named Mary Catherine Reboldi, of parents unknown say some people; his natural daughter affirm others, among whom, I believe, is Mme. de Brimont herself. However this may be is of no consequence; the Vicomte obtained the little girl from the Convent of the Sisters of St. Vincent de Paul in England, where she had been deposited, brought her to France, educated her with as much solicitude as if he had been her real father, and finally bequeathed to her all the fortune which, by French law, he could alienate from his relatives. This is the will which the family now tries to break on the ground of "undue influence and enfeebled intellect." The case will be pleaded by two lights of the Bar—the Parisian M. Tézénas for the plaintiffs, M. Paris, of Rheims, who is one of the Executors, for the defendant.

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THE ELECTRIC LIGHTS ON THE SAVOY STAGE.

1907

The system of lighting the stage of the Savoy Theatre by electricity, which was subjected, as already described in our columns, to a private experimental trial on Tuesday last, was yesterday brought to a final and a more satisfactory test, electricity being for the first time substituted for gas both at the afternoon and evening performance of "Patience." The effect upon the scenery and the aspect of the performers fully confirmed the favourable impression which we have already recorded, and much interest was exhibited in the trial on the part of the crowded audience assembled. At the close of the first act Mr. D'Oyly Carte presented himself in front of the curtain, and delivered a brief address explanatory of the system, and of the advantages which it possesses in diminishing the risk of fire. A practical demonstration of this valuable feature was then afforded, which, though sufficiently alarming in appearance to cause a visible movement towards the exits on behalf of one or two nervous visitors, proved to be as completely innocuous as had been predicted. Standing in the centre of the fore part of the stage and close to the footlights, an official of the theatre held in his hand one of the Swan lamps, which, being connected by wires with the electric current, and shown without any ground glass globe or other moderating influence, gave forth from its glowing threads of carbon the usual brilliant light. This having been first enveloped in several yards of cotton gauze of a highly inflammable nature, at a signal from Mr. Carte the lamp was shattered by a stroke of a hammer, the only effect being that the white glow, whose rays had penetrated with ease through the thin medium, instantly vanished, and the folds of the gauze falling in upon the carbon, which but the instant before had been incandescent, remained perfectly unharmed. The extreme tenuity of the film of carbon, in fact, causes it to part with its heat upon contact with the air with a rapidity that is practically incalculable. It may be inferred from this how little chance there would be of mischief from any of the more solid substances which surround the numberless gas jets on a stage falling on to the electric lamps, or even from the accidental fall among the canvas and woodwork about a crowded stage of entire "battens" or rows and clusters of lights. This convincing experiment was received with loud applause; and with the intimation that any visitor would, on presenting his card after the performance, be admitted to the stage to inspect the arrangements, Mr. Carte retired. Some increase in the engine power required for generating the electric current for the maintenance of twelve hundred lamps may perhaps yet be found necessary, but practically the abolition of gas at the Savoy may now be considered to be finally accomplished, with considerable advantage in the way both of scenic effect and the health and comfort of the performers, and also with no little gain to the public safety. As regards cost, it cannot be denied that to light the entire stage by electricity is more expensive than gas—at least for the present; but as every one knows, novelties are invariably more costly than old and settled processes which have been subjected to the play of free competition, and the eager quest of inventive minds for economising processes and devices. Even within the last few days, a slightly cheaper and in some respects a better lamp than that now in use has been devised by Mr. Swan, and some of this pattern have already been substituted for his older form. To reduce the comparison to figures, the entire consumption of gas in a theatre like the Savoy would cost from 800*l*. to 1,000*l*. a year; whereas the total cost of the present electric lighting does not fall short of 2,000*l*. a year. It must, however, be remembered that this being the only theatre in which the system has been introduced in this complete way the management have been compelled to erect their own engines on adjacent ground obtained for the purpose, and to work them by their own engineers solely for the use of their theatre. Even if the present cost were absolutely incapable of reduction it is considered that; it would be well worth paying for the sake of the many advantages, both direct and indirect, peculiar to the system. Its effect upon the rate of insurance—that terribly heavy item in a manager's expenditure—has yet to be shown. At present the Savoy is, we believe, insured at a rate of one guinea and a half per cent., which, though only half the rate paid by what is deemed the most hazardous of theatrical property, is yet about sixteen times as high as the rate for ordinary dwelling houses. So confident, however, is the management of the safety of the new system, which reduces the use of gas throughout the house—stage, auditory, dressing rooms, lobbies, vestibules and all—to a mere nominal point, that if insurance offices, under the influence of custom or prejudice, should decline to reduce this rate, we believe it is the intention of Mr. Carte to drop his policies and take upon himself what risk there still may be of a fire happening at the Savoy.

THE WONDERS OF ELECTRICITY.—The hall of the Society of Arts presented last night a strikingly fresh and cheerful appearance. Benches generally occupied by sedate and serious savants were filled for the most part with children just into their teens, who met by invitation of the Council to hear a lecture under the above title by Mr. Preece. The room was beautifully and chastely lighted with electric lamps. The ordinary gaselier beneath the cupola was completely eclipsed by a particularly handsome arrangement of a pendant lamp formed as a gilded flower basket, the petals of the flowers giving off bright white radiance. The lecturer explained in the first instance to his intensely interested audience the nature and properties of energy, quiescent and in motion. Of the former class gunpowder and coal were adduced as examples, and of the latter the influence of the tide was facetiously put as such that any one who lived a million years might find the day a minute longer than now. Appreciably nearer to the immediate purpose were practical illustrations of the escape of the energy stored in sodium, in carbon when immersed in oxygen, and in the magnet in drawing along the surface of a vase of water a toy duck. On the application of energy under the guise of electricity, one of the most novel and interesting experiments was the transmission of sound by telegraph; taps given with different degrees of rapidity indicating the several letters of the alphabet. Duplex, quadruplex, and automatic telegraph apparatus were described in a facile manner that fully engaged the attention of the audience. It was incidentally mentioned that news messages can now be transmitted at the rate of 350 words a minute, and that there are 75,000 miles of telegraph cables girding the earth. A concluding illustration of the lecture was the reception through a telephone of the airs "When other lips and other hearts," and "The last Rose of Summer," played on a bugle in another room of the building, and distinctly though faintly audible throughout the hall.

1908

THE TIMES, THURSDAY, DECEMBER 29, 1881.

1909

SOCIETY OF ARTS JUVENILE LECTURES.—The hall of the society was crowded last evening on the delivery of the first of two lectures on the wonders of electricity, by Mr. W. H. Preece, electrician to the General Post Office. The hall was lighted by Edison lamps attached to brackets in pairs on the four sides of the room, and also by similar lamps inserted in glass blue-bells and white ones springing out of a handsome piece of metal work in imitation of a basket of flowers, suspended from the ceiling, and lent for the occasion by Messrs. Verity, of King-street. The lecture was illustrated by experiments and examples of the application of electricity. To make the lectures instructive as well as entertaining, Mr. Preece began by fully explaining what was meant by "work" and "energy," and how in every case of the fatigue of one body something went out of it into other bodies. That something was energy, or the capacity for doing work, and it was a measurable quantity found in various forms, such as mechanical motion, chemical action, sound, light, heat, magnetism, and electricity. He showed the various ways in which energy was transferred by waves of liquid, of air, and of ether, and explained how the conveyance of electricity was affected by the properties of different substances, that were classed as conductors and insulators. The production of electricity by means of a battery was fully described, and the principal effect of electricity—viz., the production of electro-magnetism was illustrated by a very large electro-magnet, a common poker, and an ordinary electro-magnet, the latter being built up before the audience. How this principle was applied to house bells, burglar alarms, fire alarms, and other purposes was illustrated by apparatus. The lecturer then showed the application of electro-magnetism to telegraphic purposes, and how messages were transmitted by duplex and quadruplex telegraphy, and by the Wheatstone automatic apparatus, which was at the present time capable of transmitting 350 words a minute between London and Glasgow. The growth of telegraphy in this country was illustrated by a comparison between the years of 1869 and 1881. In those years the messages had increased from 6,660,000 to 30,000,000, the offices open from 2,000 to 5,500, and the income earned from £700,000 to £1,600,000. Submarine telegraphy in the same period had increased from a few miles up to 70,000 miles of wire, by which the globe is now encircled. There are now 803 newspapers and clubs receiving news, and there are 326 towns which daily receive intelligence from London. The applications of electricity to railway signalling, block signals, &c., and to telephones were finally shown. Two tunes were played at a distant part of the building entirely cut off from the room, and they were distinctly heard by the audience through the telephone. The method of punching messages, and sending and receiving them by the Wheatstone instruments was watched with some interest at the conclusion of the lecture.

SAVOY THEATRE.

An interesting experiment was made at a performance of *Patience* yesterday afternoon, when the stage was for the first time lit up by the electric light, which has been used in the auditorium ever since the opening of the Savoy Theatre. The success of the new mode of illumination was complete, and its importance for the development of scenic art can scarcely be overrated. The light was perfectly steady throughout the performance, and the effect was pictorially superior to gas, the colours of the dresses—an important element in the "æsthetic" opera—appearing as true and distinct as by daylight. The Swan incandescent lamps were used, the aid of gaslight being entirely dispensed with. The ordinary electric apparatus has the great drawback for stage representations that the flames cannot be lowered or increased at will, there being no medium between full light and total darkness. This difficulty has here been successfully overcome by interposing in the circuit through which the lamps receive the current what in technical language is called a "resistance." This "resistance" consists of open spiral coils of iron wire, which is, compared with copper, a bad conductor of electricity, its "conductivity" being only one-sixth of that of the last-named metal. This mode of reducing the current is, however, only a temporary expedient, its drawback being that much of the electric force is wasted on its passage through the iron, and a more economical method will ultimately be adopted for obtaining the same effect. The comparative safety of the new system was pointed out to the audience by Mr. D'Oyly Carte, the manager of the Savoy Theatre, who enveloped one of the lamps in a piece of highly inflammable muslin. On the glass being broken and the vacuum destroyed, the flame was immediately extinguished without even singeing the muslin. The occasion of which we speak is, we believe, the first on which an entire theatre has been illuminated by electricity alone, and the marked success of the experiment augurs well for the future of the new light on the stage.

1910

THE DAILY CHRONICLE, THURSDAY, DECEMBER 29, 1881.

1911

THE WONDERS OF ELECTRICITY.

Last evening Mr. W. H. Preece, F.R.S., delivered, at the hall of the Society of Arts, Adelphi, the first of two lectures to juveniles on "The Wonders of Electricity." The audience was largely composed of young people, but there was a good sprinkling of adults amongst those present. The room was lighted by incandescent electric lights, a number of these lights, shaded by coloured glass coverings, being attached to a chandelier specially made for electric lamps.

Mr. PREECE stated that in the lectures he proposed not only to show some of the recent wonders in electricity, but to explain the effects which had led to such astonishing results. He would reserve the subject of the electric light, with that of other applications of electricity, for the next lecture, his intention being to take his audience along step by step from the beginning. He began, therefore, by explaining the meaning of two words in common use—work and energy. If a boy threw a cricket ball he imparted energy to it which he lost himself. Work done meant energy applied, and energy applied meant work done. Thus he pointed out how in every case of fatigue of a body something went out of it and entered into other bodies. That something was energy, or the capacity for doing work, which he showed to be a measurable quantity, and to be found in various forms. This the lecturer illustrated by a piece of metal, which, under certain conditions, on being brought into contact with water produced effects of heat, light, and sound; by striking the dome of a bell, producing sound; and by inserting a piece of carbon into an atmosphere of oxygen, obtaining a brilliant effect. Energy consequently was found in such forms as mechanical motion, chemical action, sound, heat, light, magnetism, and electricity. As for magnetism, he showed a toy duck sailing, to the attraction of a magnet, round a large basin of water. Energy existed in one form in a charged cloud, and in another form when the cloud gave up its charge, which produced lightning. Dealing with the various ways in which energy was transferred, he gave the simple illustration of transferring heat from a fire to a poker by inserting the poker in the fire. So electricity was formed by energy transferred through metals. The various ways in which energy was transferred by waves of liquid, of air, and of the ether, as well as the various motions to which the molecules of matter are subject were shown, and from these he indicated how matter was divided into insulators and conductors for the purpose of conveying electricity in its proper path or restraining it in that path. He next took up the various motive forces of energy, and showed how difference of level, difference of pressure difference of temperature, and difference of potential produced those effects that rendered energy evident to the senses. Having shown forms of energy and how it was transferred, the lecturer next spoke of the production of electricity. He took zinc for example, which was a grand store of energy. From a piece of zinc in a cell, with carbon, water, and sulphuric acid, he showed how a galvanic battery might be produced and a store of electricity. In this way the production of electricity by means of a battery was fully described, and the principal effect of electricity, viz., the production of electro-magnetism, was illustrated by a very large electro-magnet, a common poker, and an ordinary electro-magnet, the latter being built up before the audience. How this principle was applied to domestic purposes—burglar alarms, fire alarms, toys, and various other purposes—was fully illustrated by apparatus. Some of these inventions had not been received in England with the same avidity as in America, where people in houses were in electric communication with doctors, messengers, the police, and the fire station, the houses having the electric apparatus in the halls. The lecturer then showed the application of electro-magnetism to telegraphic purposes, and how messages were transmitted by duplex and quadruplex telegraphy, and by the Wheatstone automatic apparatus, which was at the present time capable of transmitting 350 words a minute between London and Glasgow. The growth of telegraphy in this country was illustrated by a comparison between the years of 1869 and 1881. In those years the messages had increased from six millions to thirty millions; the offices open from 2,000 to 5,500 and the income earned from £700,000 to £1,600,000. Submarine telegraphy in the same period had increased from a few miles up to 70,000 miles of wire, by which the globe was now encircled. The marvellous employment of telegraphy for the Press was shown. There were now 803 newspapers and clubs receiving news, and there were 326 towns which daily received intelligence from London. The applications of electricity to railway signalling, block signalling, &c., and to telephones, were finally shown. The concluding experiment was with the telephone, by means of which the whole audience were able to hear the playing of a cornet in an adjoining building.

The second of the two lectures will be delivered next Wednesday.

MR. JOHN PENDER, M.P., ON TELEPHONY.

An extraordinary general meeting of the members of the Oriental Telephone Company, Limited, was held yesterday, at the City Terminus Hotel, Cannon-street, for the purpose of "considering and, if thought desirable, of passing a resolution approving and confirming a certain conditional agreement made, or intended to be made, between Alexander Graham Bell of the first part, Thomas Alva Edison of the second part, the Oriental Bell Telephone Company of New York of the third part, the Anglo-Indian Telephone Company, Limited, of the fourth part, George Edward Gouraud, Gardiner Green Hubbard, John Parks Bigelow, William Walter Cargill, and James Merrill Ormes of the fifth part, and this company of the sixth part, whereby it is proposed to effect various modifications or alterations in the subsisting agreements, for the purchase by the company of the properties and rights described in the agreement of Jan. 25, 1881, referred to in the memorandum and articles of association of this company, and the said other agreements, or some or one of them particularly, by reducing the amount of the consideration to be paid by this company for such purchase." Mr. Pender, M.P., presided. The notice convening the meeting having been read,

The CHAIRMAN said that the object of this meeting was to ask them to sanction a resolution, the effect of which they had just heard. That resolution had sprung out of the settlement of their arrangements with the vendors of the various patents, rights, privileges, and goodwill to this company. There were several parties connected with that sale, and as was usually the case where there were so many people connected with anything, there was very often some omission in regard to details. It so happened that that was pretty much the case in the bargain they made with the vendors, but he was happy to say that in closing their agreement with them they found that this company had some advantages on their side which they thought it was only right that they should avail themselves of. They had availed themselves of those advantages, and he was very glad to say that the vendors had met them in a very proper spirit. Such disputes resulted generally in being settled legally or by arbitration, but in this case they had settled the business without reference to either one or the other. The result was that they secured some £10,000 in money and £25,000 in shares. They must not suppose that they looked upon this in any other light than that of a considerable addition to their capital. They believed that the Oriental Telephone Company had bought privileges at all events as good, if not superior, to any of the existing telephone companies, and they had got, perhaps, the best field for telephonic enterprise in the world—India, with its teeming population; Australia, with its English-speaking people, and which was making such rapid progress, and undoubtedly advantage would be taken of it there very much in the same way as it had been in America. They had positions all likely to avail of this new mode of communication, and when he compared this company, with its modest capital and enormous area, possessing all the best telephonic patents, he had no hesitation in saying that they were probably the most valuable telephonic property which existed at the present time. Their capital, as they were aware, was nominally £300,000, but they would really be working on something like £115,000. He was hopeful—looking to a telegram received that day from Calcutta to the effect that at Bombay, Madras, and Calcutta exchanges would be opened, and that when these exchanges were open their concern would be dividend-paying. They were aware that the company had not yet been 12 months in existence, and that all these works had to be constructed. They entered on a field which was barren of everything in the way of telephonic instruments, except the few that had been sent out merely to be on the ground at the time they took possession. The whole thing had to be constructed; they had to make arrangements with the Indian Government, and fortunately they had made such arrangements as would give considerable encouragement to private enterprise there. The accounts received showed that everything seemed to be of the most encouraging nature. In Egypt they had their telephone at Alexandria, and their system opened there with something like 60 subscribers, a number which was likely to double in a very short space of time, so that, taking the whole thing altogether and looking at their position—there was in England alone the United Company with its capital of £100,000, which he believed was now worth about one million in the market; the National Company £600,000, the Lancashire and Cheshire £250,000, the Consolidated Construction £300,000, the British and Irish £100,000, and the European £500,000—the Oriental Company had got with their limited capital an area more extended than all those he had mentioned put together, and he hoped that with their limited capital and with even moderate returns from the different places they were now acting upon—Calcutta, Bombay, Madras, Egypt, and he hoped before long the Straits Settle-

ments, Java, Hong Kong, and China—they would be able to show a very satisfactory state of things before the coming year ended. They were richer by £35,000, and he thought their property had much more increased in value than when he had the pleasure of addressing them four months ago. He wished to mention that one of their stations was at Honolulu, and they had there 175 subscribers, which was a remarkable evidence of the progress of those islands, and there was every prospect of that number going up to 200. In conclusion, he moved a resolution authorising the directors to confirm the agreement referred to in the notice convening the meeting.

Sir JULIUS VOGEL seconded the proposition, which was agreed to without discussion.

The CHAIRMAN said he felt disposed to congratulate them on the amended agreement. Looking to the progress of telephonic property since they made the purchase, he thought they had a very valuable property indeed on hand, and if the concern was sold now he believed they would have a great many competitors for their property, considering the competition which was going on and the prices at which the shares stood in the market.

A vote of thanks having been passed to the chairman and directors,

The CHAIRMAN said, as they were aware, he was intimately connected with the submarine telegraph system. When he looked back 12 years ago to the trouble and labour they had to establish this system, and when he told them that within those 12 years they had put £25,000,000 into the sea and at the present moment there was not a centre of commerce or civilisation in the world which was not connected with the submarine telegraph, it was almost unnecessary to state that his hands were perfectly full when he took up this subject of telephone enterprise; but he thought it desirable to combine, as far as possible, the working of the two systems, and he anticipated before long that the telephonic system would be going hand-in-hand with telegraphic systems throughout the world, and for this reason he occupied the chair of this telephone company. He had a great desire to see this enterprise progress, and he believed that there was for the telephone an enormous future.

The meeting then separated.

1912

1913

1914

ECONOMY OF ELECTRIC LIGHTING

BY

INCANDESCENCE.

By JOHN W. HOWELL.

ments, Java, Hong Kong, and China—they would be able to show a very satisfactory state of things

ECONOMY OF ELECTRIC LIGHTING BY INCANDESCENCE.

By JOHN W. HOWELL, Stevens' Institute of Technology.

I.—Economy of the Generator. II.—Economy of the Conductor. III.—Economy of the Lamps.

In writing this thesis I have endeavored to determine as nearly as I was able the cost of electric lighting by incandescence. Owing to the interest attached to the subject, and the lack of data upon which calculations can be based, I have endeavored to consider the subject in all its details, and have taken every precaution that suggested itself to guard against error.

The data given are sufficient to calculate the number of lamps to be obtained from each indicated horse power in a steam engine; beyond this I have not attempted to go, as my experience is insufficient to enable me to make any further determinations.

EFFICIENCY OF THE GENERATOR.

The generator tested was one of the latest pattern devised by Mr. Edison. It differs from the generators heretofore in general use, principally in the substitution of bars of copper for wires in the armature, which make the resistance of the armature very low and also economizes space, as the bars have a trapezoidal section, and when in position there is only clearance enough to allow for the insulation between them.

In my experiments the field was excited by a current shunted from the main circuit, the relative resistances of the mains and magnet coils determining the amount of energy expended on the magnets, and consequently the intensity of the magnetization and the electro-motive force of the generator.

APPARATUS FOR MEASUREMENT OF THE MECHANICAL ENERGY TRANSMITTED TO THE GENERATOR.

In measuring the energy transmitted to the generator, the dynamometer built by the class of '79 was used. This was carefully standardized by supporting the pendulum in a horizontal position at a point 2 feet from the axis of the shaft, and weighing the pressure of the support upon a platform scale; the weight of the pendulum and support was 183.25; the weight of the support was 12.1; the weight of the pendulum was 171.2 lbs.

This gives us the force acting at the circumference of a pulley of 1 foot radius by multiplying 171.2 by the sine of the angle of deflection. This is a measure of the force transmitted through the gear at the top of the pendulum, and includes, beside the force required to turn the armature in the field of force, the force necessary to overcome the friction of the dynamometer bearing, and also the friction of the armature shaft in its bearings. In order to determine what part of the transmitted energy was lost in overcoming friction, a Prony brake was applied to the pulley of the armature, close beside the belt, while the generator was running. Removing the brushes to be sure no current was generated, we tightened the brake until the pendulum showed the same deflection that it did during the test; we thus made a direct substitution of the Prony brake for the retarding action of the lines of magnetic force upon the armature when the circuit was closed, and the force exerted by the arm of the brake, upon a platform scale reduced to the radius of the pulley, will be the force required to turn the armature in the field of force. Instead of measuring the pressure exerted by one arm of the brake upon a scale, we measured the lifting effort exerted by the other end upon a weight resting upon the scale. We placed a light counterweight upon the other end of the brake, to make the zero reading more definite, and in getting the zero we raised the counterweighted end, and let it down gently, rapping the center of the brake to prevent sticking.

Several readings fixed the zero between 35½ and 35. Running at about the same speed as in the test, and tightening the brake until we got a deflection of 42°, we made several readings on the scale, which varied from 19 to 20¼. Using the highest zero reading and the lowest running reading, we get a force of 16½ lbs. acting at a

distance of 2 feet from the center of the shaft; this reduced to the radius of the armature pulley gives $16\frac{1}{2}\times\frac{24}{5}=79.2$ for the force acting at the circumference of the armature pulley. If no friction had intervened this force would have been

$$\frac{171.2\times(\text{sine }42^{\circ}=66.913)}{125}=91.644 \text{ lbs.},$$

showing a loss of $91.644-79.2=12.444$ lbs., or $13\frac{1}{2}$ per cent. of the power transmitted.

This loss of $13\frac{1}{2}$ per cent. is caused by the friction of the dynamometer and the friction of the armature bearings. To get the force actually applied at the circumference of the pulley on the armature shaft, we must determine the friction of the dynamometer bearing alone. To do this we made a wooden brake of the same diameter as the driving pulley on the dynamometer that could run on a 10-inch pulley on the dynamometer shaft, we then clamped the Prony brake upon the dynamo pulley, and also clamped the belt on the dynamo pulley and passed it over the wooden brake. Running under these conditions and tightening the wooden brake on the 10-inch pulley until the pendulum showed a deflection of 42°, we measured the force acting at the circumference of the dynamo pulley and also at the circumference of the dynamometer pulley by the lifting effort of the Prony brake upon the weight on the scale. The object of this arrangement of brakes was to get the friction under the same conditions as those under which we ran the test. To get the zero reading in this case we clamped the Prony on the dynamo pulley, and loosened the wooden brake and counterweighted the other arm of the Prony brake, until the armature turned in its bearings; then letting it come to rest and rapping the bearings of the dynamo and dynamometer, we determined the zero reading to be 33 lbs. Several readings fixed the readings for 42° at 16 lbs., therefore the force acting at the circumference of the dynamo pulley was $(33-16)\times\frac{24}{5}=81.6$, showing a loss of $91.644-81.6=10.044$ lbs., or 10.9 per cent. of the total energy transmitted.

APPARATUS FOR THE MEASUREMENT OF ELECTRICAL ENERGY.

The resistance over which the generator worked consisted of three strands of iron wire in multiple arc, each of which was .104″ in diameter. These were stretched from one gallery of the shop to the other in the open air.

In measuring the resistance of the different parts of the circuit wires were led from the binding posts of the generator to the Wheatstone bridge, then by breaking the connection with the armature and magnet coils, we could measure the resistance of the line, or by breaking the connections with the line and magnets we could measure the resistance of the armature and leaders, or by breaking the connections with the armature and the line we could measure the resistance of the magnet coils.

The electrical energy developed in the circuit was determined by three methods:

1st. By a voltameter, or a copper-depositing cell.

2d. By a calorimeter.

3d. By measuring the electro-motive force and resistance.

FIRST METHOD.

The voltameter consisted of a glass jar large enough to hold six plates of copper, 7″×8″.

These were placed ½″ apart, and held in place by a light wooden frame. They were connected alternately to the positive and negative wires from the generator. This method of arranging the plates brings both sides into action, gives a large area of plate, and makes the resistance of the cell very low and the consequent heating very little. By means of mercury connections the voltameter could be thrown into or out of circuit instantly without breaking the current, and the leaders were so proportioned that throwing it in and out did not alter the resistance of the circuit.

In calculating the current from the weight of copper carried from one set of plates to the other, the weight gained by the negative plates was considered as the weight carried over, and the constant .32456, given by Sprague (Jenkin gives .324) for the amount of copper in milligrams carried over in one second by a current of one Weber. Before making the test, the current was passed through the voltameter for some time, in a direction opposite to that in which it was passed during the test, to insure that

the copper carried over during the test was copper that had been deposited before, otherwise energy may be lost in separating the copper from the positive plate.

SECOND METHOD.

In determining the electrical energy by the second method, a calorimeter was used which consisted of a cylindrical vessel of galvanized iron encased in a wooden jacket, and so supported as to leave an air space of about ½ an inch on all sides between the calorimeter and the jacket. This prevented any great conduction of heat from the calorimeter to external objects; still some heat must be wasted in heating the calorimeter and the surface it rests upon.

To determine the amount of heat thus wasted 55 lbs of water was put in the calorimeter, and its temperature carefully determined it was 19.85°C. A large pail of water was then heated to 54.3°C, and 18¾ lbs. were poured into the calorimeter. This made the weight of water in the calorimeter about the same as was used in the test, and the same part of the calorimeter was heated in each case, the final temperature of the water being 28.50°C, the range of temperature used in the test was included in this range. The heat contained in the water poured into the calorimeter may be represented by $18.75\times26.2=491.25$. Of this $55\times8.65=475.75$ went to raise the temperature of the water in the calorimeter, and the remainder 155 must have been imparted to the calorimeter. As the range of temperature in the calorimeter was 8.65°, 1.78 of these units were required to raise the temperature 1°, or the same amount of heat was used in heating the calorimeter as would be required to raise 1.78 lbs. of water through the same range of temperature; therefore the proper correction may be applied by adding 1.78 lbs. to the weight of water in the calorimeter.

To measure the heating effect of the current, a coil of copper wire was put into the calorimeter, the resistance of which was exactly $.1\frac{1}{15}$ Ohm, at 74° F. The chief source of error in a calorimeter test of this kind is the tendency of the current to pass from one part of the wire to another through the water, instead of passing through the wire. This in itself is not a source of error if we measure the resistance of the coil in the water, but in so passing, it may carry metal from one part of the wire to another, and the energy so used cannot be calculated, and is lost; to obviate this difficulty distilled water was used, the resistance of which is much higher than ordinary water. The resistance of the coil measured in the water did not differ perceptibly from its resistance in the air, and at the close of the test no evidence of copper having been carried from one part to the other was discernable. To determine the range of temperature during the test, a Fahrenheit thermometer was used that was graduated to fifths of degrees, but the graduation was so plain that twentieths of a degree could easily be read. In order to be certain that the temperature of the water was uniform throughout a pump was placed in the center of the calorimeter, which consisted simply of a copper tube about 1¾″ in diameter, its bottom was ½″ above the bottom of the calorimeter and contained a valve opening downward; the piston also carried a valve opening downward. The water in the calorimeter covered the top of the tube, and by this means the water was taken from the surface when it is warmest, and carried to the bottom, where it is coldest. The circulation thus obtained was very perfect, as shown by some ink drops put in the pump barrel.

THIRD METHOD.

In determining the electrical energy by he third method, the electro-motive forcet was measured between the binding posts of the generator, by means of a Thomson high-resistance galvanometer. As a standard of electro-motive force, Latimer Clark cells were used, four of which were made up new for the purpose. These agreed with each other very closely, and in using them they were connected in series, thus getting their combined effect, and averaging their errors.

In using them they were allowed to charge a condenser, and the condenser was then discharged through the galvanometer.

The deflection produced is an accurate measure of the current flowing through the galvanometer and consequently of the charge held by the condenser, which depends upon the electro-motive force of the terminals connected with the condenser. To connect the condenser alternately with the cells and the galvanometer, a simple switch was used by which the change could

be made instantly. In making the test part of the condenser of $.2\frac{7}{10}$ microfarad capacity wire used and four standard cells in series. The damping magnet of the galvanometer was then adjusted until the discharge of the condenser produced a deflection of 291 divisions, as the electromotive force of the cell is 1,456 volts and four in series were used, the deflection corresponding to one volt was $\frac{291}{1.456\times 4}=50$. The instrument being standarized in this way, the liability to error was very small; in use, however, $\frac{9}{10}$ of the current was shunted from the galvanometer, only allowing $\frac{1}{10}$ to pass through, thus getting five deflections to a volt.

The ends of all wires dipping into mercury were amalgamated with mercurous nitrate, which made the connections very perfect.

In measuring the resistances of the armature and of the armature and leaders, the Wheatstone's bridge was used, and Thomson's reflecting galvanometer in place of the small galvanometer usually employed. The resistance of the armature mains and leaders was between .17 and .18 Ohm. When the bridge indicated .17 the galvanometer showed a deflection of 29.5 divisions; when it indicated .18 the galvanometer showed an opposite deflection of 45. From this we get the resistance of the armature mains and leaders, .17395 Ohm.

The main alone measured .14460, leaving for the resistance of the armature and leaders to the binding parts .029 Ohm.

Leading wires being clamped on the commutator the resistance measured in several positions was .16207. These leaders measured .14604, leaving for the resistance of the armature alone .016 Ohm.

The resistance of the field magnet coils was 37. Ohms.

TEST BY VOLTAMETER.

Before making the test the generator was run for some time to allow the circuit to heat up, and the resistance of the line measured from time to time until it was found to remain constant. The voltameter was then introduced into the circuit and allowed to remain fifteen minutes.

During this time the speed of the dynamometer was determined for ten minutes, and the average speed computed.

The deflection of the pendulum was observed every three minutes and the average taken, although the variation was only one degree. At the end of the test the circuit was broken and the resistance again measured, and it was found not to have changed perceptibly.

The plates were then removed, washed in water, then in alcohol, and dried in a gentle heat. They were then weighed carefully.

DATA OBTAINED FROM THE TEST.

Weight of copper gained by negative plates =24,465 m. g.
Time of test = 15 minutes.
Weight gained per second = 27,183 m. g.
Average speed of dynamometer = 400.5 rev. per min.
Average deflection of pendulum = 42° 20′.
Resistance of iron wire = .76 Ohm.
Resistance of iron wires and magnet coils in multiple arc = .744 Ohm.
Total resistance of circuit = .744 + .029 = .773 Ohm.
Internal resistance of armature = .016 Ohm.

RESULTS OBTAINED FROM DATA.

Value of current in webers $=\frac{27.183}{.32456}=$ 83.753.

Electrical energy $(83.753)^2\times .773\times 44.24=$ 239880.726 ft. lbs. per minute.

Energy indicated by dynamometer $171.2\times(\sin 42°=.67344)\times 4505\times 6.2832=290125.54$ ft. lbs. per minute.

Friction of dynamometer and generator $290125.54\times .135=39166.9479$ ft. lbs. per minute.

Energy used in turning armature in field of force $290125.54\times 855=250958.59$ ft. lbs. per minute.

Friction of dynamometer alone $=290125.5\times .109=31623.68$ ft. lbs. per minute.

Energy actually applied to armature pulley $290125.54\times .891=258501.96$ ft lbs. per min.

Of the total electrical energy 239880.7 $\frac{.016}{.773}=4965.189$ appeared in the armature, $\frac{.744}{.773\times 49.68}\times 239880.726=4647.39$ in the magnet coils, and 230268.176 ft. lbs. per minute in the external circuit.

The efficiency of the generator is the ratio of the energy required to turn the

armature in the magnetic field, to the total electrical energy developed $=\frac{239880.726}{250958.59}=.955$.

The commercial efficiency is the ratio of the energy required to drive the machine (including friction) to the electrical energy which appears in the external circuit $=\frac{230268.169}{258501.96}=.8608$.

TEST BY MEANS OF THE CALORIMETER.

As in the voltametric test the generator was first run until the circuit was thoroughly heated, and the same care was taken to determine the speed and deflection of the dynamometer. When the calorimeter was thrown into the circuit an approximately equal resistance was thrown out so as not to change the total resistance too much. At the end of the test the resistance of the circuit was measured carefully as soon as the circuit was broken and before the wires became cooled.

DATA OBTAINED FROM THIS TEST.

Water in calorimeter = 77 lbs.
Connection for waste heat = 1.78 lbs.
Range of temperature = 79° − 69.8° = 9.2°F.
Specific heat for this range = 1.0015.
Average speed of dynamometer = 394 rev. per min.
Average deflection of pendulum = 43° 24′ (sin = .68709).
Time of tests = 16 minutes.
Resistance of iron wires and calorimeter coil = .68 Ohm.
This and magnet coil in multiple arc = .667 Ohm.
Total resistance of circuit .667 + .029 = .696.
Resistance of calorimeter coil = .1 Ohm.

RESULTS OBTAINED FROM THESE DATA.

Energy developed in calorimeter =

$$\frac{78118\times 1.0015\times 9.2\times 772}{16}=35022.897 \text{ ft.lbs.}$$

per minute.

Total electrical energy

$35022.897\times 6.96=243759.36$ ft. lbs. per minute.

Energy indicated by dynamometer =

$171.2\times .68709\times 894\times 6.2832$
$=291201.46$ ft. lbs. per min.

Energy used in turning armature in field of force

$291201.46\times .865=$
251889.265 ft. lbs. per min.

Energy actually applied to armature pulley

$291201.46\times .891=$
259460.5 ft. lbs. per min.

Of the electrical energy

$$243759.36\times\frac{.016}{.696}=5603.66$$

appeared in the armature

$$243759.36\times\frac{.667}{.669\times 54.41}=4215.89$$

in the magnet coils; and 233939.81 ft. lbs. per minute appeared outside.

$$\text{Efficiency}=\frac{243759363}{251889.265}=967.$$

$$\text{Commercial efficiency}=\frac{233939.81}{259460.5}=.901.$$

TEST BY MEASUREMENT OF THE ELECTRO-MOTIVE FORCE AND RESISTANCE.

In this test the electro-motive force was measured between the binding posts of the generator, and the external resistance was measured between the same points.

The deflection and speed of the dynamometer were measured at the same time, the electro-motive force was observed and the resistance was measured just before and after these observations and was the same in both cases.

DATA OBTAINED FROM THIS TEST.

Electro-motive force = 53 volts.
Resistance of circuit (external) .64 Ohm.
Resistance between binding posts .629.
Average speed of dynamometer, 355 rev. per min.
Average deflection, 42° (nat. sine = .66913).
Total resistance of circuit, .658.

RESULTS OBTAINED FROM THESE DATA.

Energy developed in external circuit

$$\frac{(53^2)}{629}\times 44.24=197567.43 \text{ ft. lbs. per min.}$$

Total electrical energy

$$197567.43\times\frac{.658}{.629}=206673.0295 \text{ ft. lbs. per min.}$$

Energy in armature

$$206673.029\times\frac{.016}{.658}=5025.5.$$

Energy in magnet coils

$\frac{(53^2)}{37} \times 44.24 = 3346.667$ ft. lbs. per min.

Energy in external circuit 198300.88 ft. lbs. per min.

Energy indicated by dynamometer

$171.2 \times .66913 \times 355 \times 62332 =$
$2553 + 9.04$ ft. lbs. per min.

Energy used in turning armature in field of force

$255519.04 \times .865 =$
221023.97 ft. lbs. per min.

Energy actually applied to armature pulley

$255519.04 \times .891 =$
227667.47 ft. lbs. per min.

$$\text{Efficiency} = \frac{206673.0295}{221023.97} = .935.$$

$$\text{Commercial efficiency} = \frac{198300.88}{227667.47} = .87.$$

Average efficiency, .951.
Average commercial efficiency, .887.

ECONOMY OF THE CONDUCTORS.

The economy of the conductors which convey the electricity from the generator to the lamps may be considered under two heads: first, the efficiency of the material, second, the efficiency of its dimensions.

The efficiency of any material is determined by its price and conductivity as compared with other materials. The two materials most commonly used for conductors are copper and iron. The present price of copper is about seven times the price of iron and its conductivity is about six times as great; thus the actual cost of a line of copper wire of a given conductivity is one-sixth greater than iron wire of the same conductivity. Copper wire, however, is much more uniform than iron wire; it is free from cinder streaks that are so common to iron wire, and is much more pliable and less bulky, and therefore less difficult to handle. For electric-light mains, which have to be frequently tapped, copper wire seems to be preferable to iron wire.

2D. THE EFFICIENCY OF DIMENSIONS.

This is determined by the cost of the conductor and the loss of energy in the conductor. As the energy developed in different parts of the circuit varies directly as the resistance of these parts, some energy must appear in the conductors. This energy appears as heat, and is lost.

The most efficient dimensions of the conductors depend upon the amount of energy to be transmitted and the distance which it is to be transmitted.

To secure maximum efficiency, therefore, we would have to calculate the most efficient size under all conditions as to number of lamps and distances. Knowing, however, the conditions most usually met in practice, we can determine that loss of energy in the conductors, which is usually most efficient and expressing this loss as a percentage of the total energy transmitted, calculate the size of our conductors upon this basis by making the resistance of the conductors the same percentage of the total resistance of the circuit, as the loss of energy allowed is of the total energy transmitted.

Thus, when we wish to calculate the dimensions of our conductors necessary to convey the current to a given number of lamps a given distance, allowing a loss of $\frac{1}{n}$ of the total energy, we must determine the resistance of our lamps and make the resistance of our conductors $\frac{1}{n-1}$ part of the resistance of the lamps.

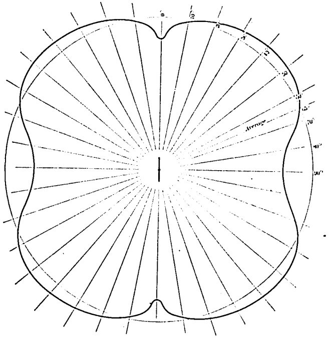
Thus we see that the cost of the conductors necessary to carry the current for a given number of lamps a given distance varies inversely as the resistance of the lamps, and although we can make a high or a low resistance lamp of the same economy, it will cost less to convey the current to a given number of high-resistance lamps a given distance, than it will to convey the current to the same number of low resistance lamps the same distance.

ECONOMY OF THE LAMPS.

The economy of the lamps is determined by the energy consumed and the amount of light produced; in determining the energy consumed in the lamps, the electro-motive force was measured between the terminals of the lamps, and also the resistance, and the energy determined in foot pounds per minute by the formula $\frac{e^2}{R}$ 44.24.

In measuring the electro-motive force the same arrangements were used as in determing the electro-motive force of the generator, but the damping magnet was adjusted to give three units of deflection to a volt instead of five. To measure the

resistance of the lamps when burning, the current was divided into two parts, one part was passed through the lamp and the other through a variable resistance, when both were passed through a differential galvanometer, but in opposite directions; when the current was the same in both branches, the needle of the galvanometer



CURVE SHOWING ILLUMINATION OF EDISON'S LAMP IN A HORIZONTAL PLANE.

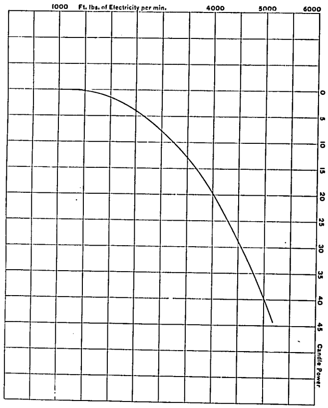
would indicate zero. As the electro-motive forces of the two branches were equal, their currents were equal, when their resistances were equal, so by altering the variable resistance until the needle came to zero, and measuring the variable resistance we thus determined the resistance of the lamp while it was burning. This variable resistance was measured each time before it cooled.

As the light given out in a horizontal plane varies at different angles, the angle of average illumination was first determined for the lamp used, which was the Edison lamp. To determine this angle, the candle power was measured every 10° through a quadrant, and the candle power observed laid off on a suitable scale on lines radiated from a point. A curve was drawn through the points thus determined, and the four quadrants being made symmetrical, its area was determined and a circle of equal area drawn about the point from which the lines radiate. The points where this circle cut the curve determine the angle at which the candle power is the same that it would be if the light were evenly distributed.

Having determined the angular position of these points with reference to the plane of the carbon, all measurements were made with the axis of the photometer in this angle.

To insure that the lamp was in this position, it was twisted until the shadow of the carbon fell on the center of the disc and then turned through an angle of 65°, which the curve shows to be the proper angle. All measurements of lamps were made at the angle of equal illumination.

In order to determine the economy of a lamp at different degrees of incandescence, an Edison lamp was measured at intensities ranging from a dull red to 40 candle power, and the results plotted in a curve show a rapid rise in economy as the candle power increases. While the economy of a lamp increases with incandescence, its life shortens, but as I have had neither time nor opportunities for life tests, I cannot give data for life at various degrees of incandescence.



CURVE SHOWING RELATION BETWEEN ECONOMY AND INCANDESCENCE.

Mr. Edison's standard of illumination has been 16 candle power, and his aim has been to produce a lamp that will give good economy and a reasonable life at that candle power.

To determine the energy consumed by these lamps when burning at their normal candle power, five lamps, as made at present by Mr. Edison, were tested with the following results:

TABLE SHOWING ENERGY CONSUMED BY EDISON LAMPS.

	Candle Power.	Volts.	Ohms.	Foot-pounds of Electricity per minute.
1	16	98.60	135.5	3178 – 03
2	16	98.66	142.5	3021 – 91
3	16	99.	140.5	3107 – 41
4	16	98.	148.5	2861 – 15
5	16	99.33	131.5	3319 – 32

Showing an average of 3,097 – 564 ft. lbs. of electricity per minute, or 10.65 lamps per h. p. of electricity, giving 170 candles per h. p.

Mr. Edison gets 10.65 lamps per horse power of electricity, but as he allows a loss of 10% of the electrical energy used in the lamps upon the conductors, he gets 9.68 lamps for each h. p. of electricity generated. As the average commercial efficiency of this generator is .887, this gives him 8.58 lamps per dynamometrical h. p.

The report of the Board of Commissioners of the Millers' Exhibition, held in Cincinnati just one year ago, gives the results of the trial of three modern steam engines.

These results show an average for the three engines of .878 of the indicated power converted into useful work; using this factor for the conversion of dynamometrical into indicated horse power, we find that Mr. Edison gets 7.62 lamps per indicated horse power.

1921

1923

AN ELECTRIC BUOY.—A daily contemporary states that experiments are being made in the Lower Bay, New York, with a new electric buoy, the invention of Mr. Bigler, of Newburg. Mr. Bigler, it appears, owns the patent of the old Courtney Whistle Buoy, the principle of which he combines with an intermittent light, the same power which blows the whistle being used to generate the electricity that furnishes the light. The rise and fall of the waves compresses the air inside the buoy. When this pressure has reached a certain point, it works a dynamo machine and burner furnished by the Edison Electric Light Company. This machine is supposed to generate enough electricity to show an intermittent light. When the pressure is exhausted by the action of the machine, which makes about 300 revolutions per minute, the light goes out until the pressure is renewed by the motion of the waves. The more violent the waves the more powerful the light, up to a certain point. Thus the light is at its brightest during a hurricane.

ELECTRIC LIGHTING AT THE SMOKE ABATEMENT EXHIBITION.—Several systems of electric lighting are being shown at the Smoke Abatement Exhibition, now being held in the buildings adjoining the Albert Hall, South Kensington. Messrs. Siemens Bros. have some Swan incandescent lamps running, fed by one of their upright dynamos, which in turn is driven by one of Crossley Bros. "Otto" gas engines, supplied with gas from a Dowson economic gas producer. This exhibit i one of the best combinations of gas and electricity that have been seen for some time. It is stated that the Dowson gas producer will make gas at a cost of only 3d. per 1,000 cubic feet. The producer is connected with a holder, which, of course, can be of almost any capacity. It would be interesting to know what would be the cost of running a certain number of incandescent lights, with a dynamo machine driven by a gas engine, fed from one of the Dowson producers. No doubt our readers will be able to see some such combination as that now shown at Kensington at the Crystal Palace Exhibition, as we notice that the Dowson Economic Gas Company (it was misprinted *Dawson* in our recent list of exhibitors) are to exhibit their apparatus there. In addition to the Swan lights, we believe that Messrs. Siemens are to show Dr. Siemens's method of melting iron by means of the electric arc in a furnace of his construction. It is stated that in practice a current of 100 webers, having a resistance of 50 ohms, and representing six horse-power of energy, will melt 1·5 kilogram of steel in a quarter of an hour in a hot crucible. A model of the Siemens electrical railway, which has become so well known lately, is also to be shown. Mr. Crompton will be represented by his arc lamp, which will be fed by a Bürgin machine, driven by one of Clerk's gas engines, made by Messrs. Thomson, Sterne and Co., of Glasgow, and recently described and illustrated in these columns (*Electrician*, Vol. VII., p. 393). The same engine and dynamo will also run several of Edison's incandescent lamps, which have been fixed up in the neighbourhood, some pendant, and some fixed like gas brackets, which are shown by Mr. Johnson, of Holborn Viaduct, Mr. Edison's agent in England. An Edison dynamo machine is also shown. Messrs. Rowatt and Fyfe were to have been represented by the Pilsen lamp, fed by a Schuckert machine; but, on the occasion of our last visit to the Exhibition, their apparatus, however, was not yet in place.

1924

ELECTRICITY *VERSUS* GAS.

ABOVE five years ago I pointed out that land would fall in value. It seemed to me evident that this would be the case, because larger and larger tracts of Western prairie were each year being converted into great corn farms, and the means of transport of this corn to our ports were each year rendered more easy. No one, however, believed me before the event proved that I was right, for one of the peculiarities of the English mind is, that it can never realise that what is, will ever cease to be, until the "will be" has become the "is."

When Edison made his discoveries in electric lighting, again I raised my voice, and said—or, to put it more accurately, again I raised my pen and wrote—that the wise who held gas shares would do well to sell them. Edison's invention was not perfected. Gas directors jeered at it; it would never be more, they said, than a pretty theory; and even if it were to vanquish gas as a lighting medium, the Companies would sell as much gas as they do at present for heating purposes, and this, with the sale of their "residual products," would secure to them as good profits as heretofore. Now I was as well aware as others that the idea of lighting by electricity had not as yet assumed a clear practical form, but I knew that the minds of so many would be devoted to giving it that practical form, that in the end they would succeed; whilst, as to selling gas for heating purposes and selling "residual products," I had calculated the results, and knew what they were.

Let those who hold the shares of Gas Companies ponder over the following facts and figures. If they regard them as incorrect, then let them keep their gas shares; if, on the other hand, they arrive at the conviction that they are correct, they will take advantage of the folly of the mass of mankind and accommodate some fool with their shares before the collapse comes.

The mode in which electrical light is produced is very simple, and can easily be comprehended when explained in plain and unscientific language. If you move a wire near the poles of a magnet backwards and forwards along what are called its lines of force, a current of electricity is attracted to the wire, and runs from one end of it to the other, provided there be a complete circuit. The strength of the current is in proportion to the size of the magnet and to the velocity with which the wire is moved across the "lines of force." Having got a magnet and a wire, the next thing, therefore, is to adapt motive power to them, which moves the wire quickly—that is to say, to a steam engine. The engine, wire, and magnet together, then, form a machine which is called a "generator." With its aid, a stream of electricity is thrown into the wire. Now, if the wire be cut at any place, and then the interval between the two points be bridged over with a filament of carbon, the electricity passing through the carbon becomes incandescent. This constitutes the incandescent lamp. The carbonised filaments are enclosed in globes of glass in which there is no air, and in which, consequently, the filament lasts for several months without being destroyed. There are other systems all based upon one principle and called "the arc," in which the electricity leaps from one stick of carbon to another, and in which the sticks burn like candles. In street lighting, the arc is used, and, light for light, it is cheaper than gas. In the City the Electric Companies that light the streets are paid what the Gas Companies were, and for this they supply four times as much light. Gas is used to work the generators, but the amount of gas which would maintain a light of 12-candle power, employed in turning a generator, produces an arc of 1,600-candle power. If the same engine were employed to supply the incandescent lamps, the same quantity of gas would produce 12-candle power lamps, with an expenditure of a sixteenth part of the gas now requisite for this. The reason of this is, that incandescent lamps have to be worked at a much lower temperature than arc lamps.

Electric light supplied to houses ought not to be, even in the present condition of the light, dearer than gas. Mr. Edison is now laying down 500 miles of electric light mains in New York City, and he will light every house with his incandescent lamps at the price which the owners are now paying to the Gas Companies. As a matter of fact, however, the light can be produced, as soon as mains are laid down, at a far less cost than gas.

The present condition of the electric light in London is: streets are now being lighted with it at one-fourth of the price of gas; incandescent lamps can be introduced into every room of any house so soon as the mains are laid; there can be a separate meter to each house; the lamps can be separately lighted, and put out by turning a cock; if one light goes out, no other one is affected; the sub-division is so complete, that there is no glare, and yet a room with incandescent lamps is far more brightly lighted than with an equal number of gas lamps; and an equal amount of candle-power produced by electricity is cheaper than an equal amount produced by gas. In addition, the electric light has no odour, it does not vitiate or heat the air, nor does it, like gas, tarnish paint and decoration.

Are we then seriously to believe that electricity will not replace gas for lighting purposes? When railroads were in their infancy, there were many who refused to believe that the public would seriously prefer them to the good old coaches. Yet the coaches have disappeared in favour of the railroads. So it will be with gas. We use this foul product because its advantages have outweighed its disadvantages. We are, however, not blind to the latter. If we can find something which will secure to us still greater advantages, and which will be without its disadvantages, can any one suppose that we are so enamoured with the heated atmosphere, with the foul smell, and with the destructive properties of gas, that we shall continue to light our rooms with it?

In order to realise what a Gas Company is, and what its prospects will be, when electric light is substituted for gaslight, it is only necessary to analyse the accounts of a Company, and as the Gaslight and Coke Company is the most important London Gas Company, I will take its published accounts for 1880 in preference to any other.

This Company has a capital consisting of debentures, and of various denominations of shares, in all amounting to £9,277,122. Its revenue for the year was £2,612,566, derived from the following sources:—Gas, £1,984,019; residual products, £585,480; metres, £37,813; and sundries £5,260. Its expenses were £1,712,656; and consequently its net revenue was £899,910. The capital is probably about £3,000,000 above the real amount for which all its plant might be brought into existence, and its net revenue might be increased by about £50,000, were its resources economically administered, for in its Dr. account I see that its directors receive £7,000, its law expenses are £4,669, its bad debts are £11,871, its collectors receive a commission of £24,707, and its superannuation and annuities amount to £17,969, whilst all other items are upon the same astounding scale.

It is clear that were the Company to pay 5 per cent. all round on its capital and on its debentures, its profit would not be too large a one. This it might do, were its net revenue reduced by £463,856, and, as it receives for gas £1,984,619, it practically receives from gas consumers about 9d. per thousand cubic feet above what it ought to; and, were the works the property of the local authorities, and made with capital obtained at 3½ per cent., its present charges are about 1s. per thousand cubic feet beyond what would be required. In these estimates, I accept the preposterous capital and the preposterously wasteful annual expenditure of the Company, although, as I have already said, both are excessive.

Now, let us see what would be the effect on the Company of the substitution of electricity instead of gas for lighting purposes. To produce the electricity, one sixteenth portion of the gas now used for lighting would be required. Therefore, if the Company were to depend upon this income it would be ruined. It would consequently be obliged to endeavour to sell its gas for heating purposes. About the financial effect of this to a Company much nonsense is talked by Chairmen and Directors of Companies. It is said that the demand would be so great that the saving in purification would be so enormous, and the profit from the residual deposits would be so increased, that the profits of the Companies would be the same as they are now. A few considerations and a few figures will dispel this illusion.

A Gas Company has now to produce gas free from impurities and with a 16-candle lighting-power. It sells this gas at 3s. 2d. to 3s. 4d. per thousand cubic feet, because it has a monopoly, and because, even at monopoly price, gas is the cheapest illuminating power now on sale. If it were to sell for heating purposes it would have to compete with coal, and would have, consequently, greatly to reduce its selling price; moreover, it would have entirely to give up selling for lighting purposes, for the purified gas and the unpurified gas obviously could not pass through the same mains. I do not myself believe that gas ever will be extensively used for heating purposes, because habit in these matters is everything, and it will be long before the habit of open coal fires disappears. But I will assume that double the amount of gas is sold for heating purposes that is now sold for lighting and heating purposes, and that this is brought about by a reduction of one-half on the cost. The debit account would be reduced by £47,988 for purification, and increased by £907,036 for double the amount of coals, and by £163,877 for carbonising, and would therefore be £3,383,563, instead of £1,712,650. The credit account would be increased by £586,180 for residual products, making it £3,519,602, instead of £2,612,566. Consequently the net revenue would be £136,039, instead of £899,910. It will be observed that in this estimate, I make no allowance for the interest on new capital requisite to increase the works so as to double their production, or for an increased staff of engineers, &c., all these being supposed to be met by economy in the present wasteful revenue expenditure. Moreover, as the substitution of gas for coal would be very gradual, and probably never could take place to any extent, were not the price of gas reduced by three-quarters instead of one-half, it is clear that the condition of the Company, when electricity is in general use for lighting purposes, will not be nearly as prosperous as the above calculation supposes.

There are no valid patents that stand in the way of producing the electric current, connecting it with lamps in the streets and in houses, and making the arc and the incandescent lamps. If the right to lay mains under the streets be granted to any particular Electrical Company, that Company would have a practical monopoly, for it is clear that it would be impossible to allow rival Companies to take up the streets at their pleasure. No Company should, therefore be given these powers. For years we have regretted that the supply of gas has been in the hands of private Companies. These Companies have been allowed to charge rates to secure to them a net 10 per cent. profit on outlay, and they have enjoyed a monopoly. The consequence has been that the outlay has been reckless, that revenue has been squandered because there has been no control over it by the householders who have had to pay for it, and that the Companies and their officials have regarded their customers much as a feudal lord in the middle ages regarded the wretched serfs attached to the glebe. We must not again fall into the same error. Electric lighting must be for householders and by householders. The amount necessary for plant and working capital must be raised at 3½ per cent. on the security of the rates, and the lighting of the metropolis must be in the hands of the representatives of the ratepayers. We have, alas, no metropolitan Municipality. The only body that can take this matter in hand is the Metropolitan Board of Works.

What it ought at once to do is to appoint a commission of men of science and of practical business men, who would report upon the amount necessary to lay electric mains, to distribute generators, &c., and also the price that would have to be charged for the supply of the light to cover interest on outlay, depreciation, and working expenditure. Having acquired this knowledge, it should bring a Bill into Parliament in the session of 1882 to acquire powers to light with electricity the whole of the metropolis under its jurisdiction.

1925

1926

THE MORNING ADVERTISER, JANUARY 5, 1882.

1936

RECENT WONDERS OF ELECTRICITY.

Mr. W. H. PREECE, F.R.S., gave a second and concluding lecture on this subject yesterday evening before a numerous audience, which filled the great room of the Society of Arts, John-street, Adelphi. Recapitulating the heads of his previous lecture, he said that one of the principal objects he had in view was to disabuse the minds of his hearers of the idea that electricity was a fluid or any tangible form of matter. It could be spoken of as a distinct entity in the same manner as heat, light, or sound was spoken of, without any sensible existence being implied; but all its effects, as indeed all physical phenomena, were forms of energy. Energy was as much entitled to reality as matter. Like matter, it could neither be created nor destroyed. Human power could only transform and apply some available store of it to useful purposes. Wherever a current of electricity was produced energy was expended and work done; and energy expended at one point of a system must appear in some form or other at another point. In the last lecture electro-magnetism was shown as a form of energy, and the lecturer now showed that when electricity was driven through a chemical compound, in solution or liquid, its action was to break up the compound into its constituent parts, and the weight of the material decomposed per minute was an exact measure of the work done or of the current passed. Water, for instance, was broken up into its elements, oxygen and hydrogen, sulphate of copper into sulphuric acid and copper, and nitrate of silver into nitric acid and silver; hence the practical application of electricity to electrotyping, electro-plating, and nickel-plating, which processes were illustrated. When electricity was transferred through solids the work done appeared as heat, and a definite amount of heat appeared for every unit of energy expended, and its temperature varied with the resistance to the passage of electricity. All substances, on being heated to a temperature approaching 1,000 deg. Fahrenheit, began to emit light, commencing at a dull red glow and advancing to 2,500, when the sustaining power of carbon was reached, and the result was a rupture of the conducting material. This variation of light and heat formed the subject of some beautiful experiments. Fine wire, of platinum or iron, was shown to become intensely heated when electricity passed through it, and this effect was utilised in electric fuses for blasting purposes in mines, discharging torpedoes at a distance, firing broadsides on board men-of-war, and other practical applications. Some admirable experiments prepared for the lecturer by Professor Abel, C.B., illustrated that branch of the subject. The work done by electricity in its passage through air and gases, the lecturer went on to say, appeared as sparks and light. Sparks were due to matter rendered incandescent by the high temperature produced. Some beautiful effects through vacuum tubes, by induced currents from a large induction coil, were shown, which led up to the electric light, for which greater currents of electricity were required than had yet been shown. It was necessary to call in the aid of mechanical power to produce the currents employed for this purpose, and the steam-engine or water power was brought into requisition. The motive force was simply the motion of a conductor through a magnetic field, and the greater the intensity of the magnetic field, and the greater the velocity with which the conductor cut the field at right angles to its lines of force, the greater was the current produced. Magneto-electric machines were those in which the field was produced by permanent steel magnets; dynamo-machines were those in which the field was produced by an electro-magnet excited by the current which itself produced by a kind of accumulating action. In each case the current was the result of the mechanical work expended, and, with the exception of that portion necessarily wasted in friction, was an exact measure of the horse-power exerted. Such powerful currents were utilised in "arc" electric lamps, where rapid sparks were passed through air between two rods of carbon which were disintegrated and rendered highly incandescent; or in "incandescent" lamps, where they passed through solid carbon filaments, which became raised to a very high temperature, and therefore gave a brilliant light. The hall was again lighted by Edison incandescent lamps. It was then explained that the action of magneto or dynamo-machines was reversible, and that the currents from the first machine would cause a second similar machine at a distance to be driven in the opposite direction; hence the applicability of electric currents to the driving of cars on railways, to ploughing land, to boring rocks, to printing, to sewing-machines, to ventilation, to wood carving, and to various industrial and useful purposes, as was illustrated at the recent exhibition in Paris. The lecturer remarked in conclusion on the beneficial influence of that exhibition, on the progress of electrical applications, and of that about to be held in the Crystal Palace, and observed that while some people spoke of electricity as a mysterious agency, and a wild, untamed beast, it was only mysterious to the ignorant and untamed to the unskilled. It was an obedient slave to the experienced, but it was a very dangerous ally to the careless.

An electric light chandelier manufactured by Messrs. B. Verity and Sons, of King-street, Covent-garden, which formed part of the illuminating apparatus, was much admired for its beauty of design and general effectiveness.

1937

1938

Neueste Nachrichten, Jan. 5. 1882

1939 Straßburg, 24. Jan. Das elektrische Licht fängt in der That an, in unserer Stadt dem Gase eine ganz bedenkliche Konkurrenz zu machen. Daß die Bahnverwaltung, welche bei ihrem großartigen Bedarf gewiß einer der besten Kunden der Gaskompagnie war, schon lange und in immer fortschreitendem Maße mit elektrischen Lampen operirt, und in umgekehrtem Verhältniß die Gasbeleuchtung für ihren Betrieb mehr und mehr, schließlich vielleicht gänzlich abschafft, ist bekannt. Ganz neuerdings haben auch einzelne Industrielle, wie z. B. Herr Kolb im Finkweiler, das elektrische Licht zur Beleuchtung ihrer Etablissements eingeführt, und es scheint, als wenn ihnen bald eine größere Zahl hiesiger Geschäfte folgen würde. Wie verlautet, beabsichtigt nämlich eine Pariser Gesellschaft die Einführung des elektrischen Lichtes hier für private Zwecke, und sammelt bereits Abonnenten zu diesem Unternehmen. Sobald 1200 Lampen garantirt sind, soll die Anlage in's Werk gesetzt werden. Die Gesellschaft will die Edison'sche Lampe benutzen; sie verpflichtet sich, die Einrichtungskosten zu tragen und der Preis des Lichtes soll erheblich billiger werden, als der des Gases ist. Da ein derartiges Unternehmen sehr im Interesse vieler hiesiger Bewohner liegt, so dürfte an einem baldigen Zustandekommen wohl kaum zu zweifeln sein.

1940

"Local Anzeiger der „Presse"" 1942

1941 January 4th 1882.

[Elektrisches Licht auf dem Graben und Stephansplatz.] Heute Abends wurde die elektrische Beleuchtung auf dem Graben und Stephansplatz inscenirt, und zwar sind vier Lampen auf dem Stephansplatz, eine auf dem Stock-im-Eisenplatz und drei auf dem Graben aufgestellt. Der Erfolg der Beleuchtung war aber kein so günstiger, wie man erwartet hatte. Die Gasflammen freilich, die schienen so schwach leuchtend und ihr Licht hatte eine so matte roth-gelbe Farbe, daß das scharfe weiße elektrische Licht einen wohlgefälligen Eindruck machte. Aber es fehlte diesen Lampen doch der brillante Effect, den beispielsweise die elektrische Beleuchtung auf dem Eislaufplatz hervorruft. Es fehlt das strahlende, glänzende Element und in Folge dessen ist auch der Lichtkreis kein sehr großer. Offenbar liegt das vornehmlich an den Lampen und es wird noch manche andere Verbesserung vorzunehmen sein, bis man zur Einführung des elektrischen Lichtes wird gelangen können. In der unmittelbaren Nähe der elektrischen Flammen erreichte die Helle einen ziemlich hohen Grad, aber auf fünfzig Schritt Distanz war der Effect verschwunden. Das zeigte sich deutlich in dem Mangel jeder Fernwirkung in Bezug auf die Häuserbeleuchtung, am allermeisten aber an der Stephanskirche und dem Thurme, die in Dunkel gehüllt schienen, obwol ihnen gegenüber die elektrischen Lichter in ziemlicher Höhe angebracht waren. Für die Bevölkerung war die Beleuchtung des Grabens und des Stephansplatzes mit elektrischem Licht der Anlaß zu einem recht lebhaften Abendcorso, der auch noch in den Nachtstunden anhielt, in denen sonst unsere großen Plätze recht kleinstädtisch leer sind.

1943

Von den Boulevards.

Von

P. v. M. 1944

Die Franzosen sind doch ein recht eigenes Volk! Dinge, die man bei uns kalt und nüchtern besprechen, adoptiren oder ablehnen würde, je nach dem Ergebnisse, entfesseln hier eine Leidenschaftlichkeit, von der man sich bei uns keine Vorstellung macht. Als es hieß, der Post- und Telegraphenminister werde anläßlich des elektrischen Kongresses in der Oper eine Galavorstellung veranstalten, bei welcher die elektrische Beleuchtung auf der Bühne und im Zuschauerraume in Anwendung kommen solle, entbrannte aller Orten ein Streit pro und contra, der an Heftigkeit nur in der Ausdauer der Bemühungen, eine Einladung zu dieser Vorstellung zu erhalten, ihresgleichen fand. Aller Orten bildeten sich Parteien, Wetten wurden geschlossen und durch eine Woche hörte man überall die Namen Edison, Jablochkow, Swan, Ader, Brush &c. durch die Luft schwirren, und bekam man bald als hors d'oeuvre, bald als Dessert eine mehr oder weniger groteske Erklärung der verschiedenen Systeme. Auch unserer Gesellschaft im Café de la Paix hatte sich diese Manie bemächtigt und ich dankte in meiner Naivität Gott, als endlich der große Tag herankam, der die Sache zur Entscheidung bringen sollte. Es scheint aber der Pariser Oper zu gehen wie Prinzessin Dornröschen: daß irgend eine böse Fee, die man zur Eröffnungsvorstellung nicht geladen hat, einen Fluch über das Haus ausgesprochen — und Alles, was geschehen soll, bedarf der doppelten Zeit als anderswo. So wird an «Françoise de Rimini» von Ambroise Thomas seit Ende September studirt und hofft man Mitte Februar damit herauszukommen, und so war auch am Abende der Galavorstellung die Installation der elektrischen Lampen auf der Bühne gar nicht, im Zuschauerraume nur zum geringsten Theile durchgeführt. Die Frage blieb also bis zu der erst eine Woche später hergestellten vollständigen Installation eine offene und man mußte sich damit begnügen, zu konstatiren, daß die Galavorstellung als solche total mißlungen war und daß, wenn an diesem Abende nicht applaudirt wurde, nicht ein strenges Hofceremoniel, sondern das absolute Mißfallen an der Zusammenstellung und Durchführung des Programms schuld war. Ich will darauf gar nicht weiter eingehen und als charakterisirend nur hervorheben, daß man unter Anderem den dritten Akt von „Aida" gab, einen Akt, der in der Nacht spielt und die Anwendung von Beleuchtungseffekten gänzlich ausschließt. Nachdem ein Kollege von der französischen Presse und ich — von allen Mitgliedern der Tafelrunde im Café de la Paix die einzigen Auserwählten — während der Zwischenzeit über das wahrscheinliche Resultat der Versuche halb zu Tode waren gefragt worden, kam die Entscheidung und brachte für das elektrische Licht im Allgemeinen und für den genialen Erfinder Edison im Speziellen einen glänzenden Triumph. Die Frage kann heute als eine gelöste betrachtet werden, da, dank den famosen Regulatoren, deren Erfindung auch Edison's Verdienst ist, durch die die elektrische Beleuchtung modulirt werden kann wie Gaslicht und den immensen Vortheil der gänzlichen Gefahrlosigkeit und des Aufhörens jener entsetzlichen Hitze, unter welcher namentlich die Künstler so außerordentlich litten, bietet. Der Effekt, den die Lampen verschiedener Systeme machen, ist nun allerdings ein sehr ungleicher, und während die einen ein kaltes Licht werfen, welches im höchsten Grade unangenehm wirkt, den Gesichtern eine Todtenfarbe und den Stoffen einen höchst störenden und unangenehmen fahlen Glanz verleiht, geben andere ein Licht, welches in Folge der zur Verwendung kommenden Kohlengattung ein weit wärmeres ist und in mancher Beziehung an das Gaslicht erinnert, obwohl es viel intensiver und, ohne die das Auge beleidigende grell weiße Farbe der anderen Systeme, doch bedeutend reiner als dieses ist. Man hatte alle nur halbwegs auf Beachtung Anspruch erhebenden Systeme zur Verwendung gebracht und sowohl auf der Bühne, an der Rampe und an den Soffiten, als auch im Saale, dem Stiegenhause und dem Foyer Alles gethan, um ihnen zur Geltung zu verhelfen. Auf den Lüstern hatte man die Gasflammen theils gänzlich, theils halb eingedreht und dafür Hunderte von kleinen elektrischen Lampen montirt; in der Kuppel des Saales hatte man von Milchglasplatten verdeckt fünfundsiebenzig große elektrische Lichter angebracht, in den übrigen Räumen große mit Refraktoren versehene Lichter aufgestellt. Von allen Systemen hat das Edison'sche und die ihm nachgebildeten Swan, Marion &c. den größten Erfolg errungen. Die bereits erwähnten Eigenschaften und der bei Anwendung unter so besonderen Verhältnissen wie in einem Theater höchst vortheilhafte Umstand, daß die Edison'sche Lampe bei täglicher fünf- bis sechsstündiger Verwendung erst nach einem halben Jahre die Erneuerung des lichtspendenden Kohlentheiles erfordert, haben zur definitiven Adoptirung derselben zur Beleuchtung des Foyers geführt, in welchem sich bekanntlich das herrliche Deckengemälde Baudri's befindet, welches, von dem Rauche der Gasflammen schon bedeutend geschwärzt, einem sicheren Untergange geweiht war. Auch zur Beleuchtung der Bühne und der Lüster des Saales dürfte — obwohl eine bindende Entscheidung noch nicht erfolgt ist — das System ~~Edison's in~~ Anwendung kommen und darum möchte ich über dasselbe ein paar Worte sagen. Die Lampe, welche berufen ist, eine so gründliche Aenderung nicht nur in den bisherigen Beleuchtungssystemen, sondern auch in der Kunst, sich zu schmücken — sowohl für die Bühne als für den Saal — und sich zu kostümiren, ja sogar in den Bewegungen der Künstler und in der Malweise der Dekorationsmaler hervorzurufen, hat die Größe und Gestalt einer mittelgroßen, mit dem Stiele nach abwärts gekehrten Birne. Sie birgt in ihrem Inneren die beiden Pole der elektrischen Batterie und den dieselben verbindenden Kohlenbogen, der, von der durchströmenden Elektrizität zum Glühen gebracht, das Licht spendet. Diese Kohlenbogen haben in der Erfindung Edison's eine große Rolle gespielt und die praktische Ausnützung derselben lange Zeit verhindert. Anfänglich verwendete Edison statt der Kohle Metalle, die aber unter der Intensivität des elektrischen Stromes schmolzen; nachdem versuchte er der Reihe nach verkohltes Papier, verkohlte Wolle und die verschiedensten Holzkohlen, die aber alle nicht vollständig entsprachen, bis ihm endlich 1879 die nach allen Seiten entsendeten Botaniker eine Bambusgattung brachten, die, in China und Japan sehr häufig, allen Anforderungen Genüge leistete. Die Fasern dieses Bambus, zur Dicke eines Roßhaares zerschnitten und dann verkohlt, sind es, die Edison bleibend angenommen hat, und die es ihm gestattet haben, seine Erfindung so allgemein verwendbar zu gestalten. Die Lampen, die gewöhnlich mit einer Leuchtkraft von acht Kerzen, gleich drei Viertel einer guten Gasflamme, und von sechzehn Kerzen, gleich ein und ein halb guter Gasflammen hergestellt werden — was aber die Herstellung stärkerer Lampen durchaus nicht ausschließt, da solche zu vierundsechzig Kerzen bereits existiren — sind bald auf Armen, die sich gleich den Gasarmen beliebig biegen lassen, bald auf Lampen, bald auf reichen Lüstern angebracht und durch diese mit der Zuleitung in Verbindung gebracht. Diese Zuleitung ist wieder ein kleines Wunder. Von der Centralstelle, deren natürlich eine große Stadt viele haben wird, gehen zwei ungefähr daumendicke, auf einer Seite runde, auf der andern abgeplattete Streifen von reinem Kupfer aus, die, von einer isolirenden Masse, deren Herstellung ein Geheimniß Edison's ist, umgeben, in einem eisernen Rohre gebettet sind, welches ungefähr faustdick und nur wenige Zolle unter der Oberfläche liegend, die Leitung in den Hauptstraßen herstellt, während die Abzweigungen in die Nebenstraßen, in die Häuser und in die Wohnungen von gleichartig konstruirten, aber gradatim abnehmenden Leitern hergestellt werden. Edison hat auch durch eine sehr einfache Vorrichtung in der Zuleitung jedwede Feuersgefahr zu beseitigen verstanden. Einerseits hat, gleichwie in den Leuchtgasfabriken, auch im Centrale der Anstalt für elektrische Beleuchtung ein Wächter fortwährend eine Normallampe, sowie eine in dem zur Beleuchtung seines Distriktes dienenden Strom eingeschaltete Lampe vor sich, was ihm gestattet, zu vergleichen, wenn durch das Anschalten oder, um vulgär zu sprechen, Ablöschen einer großen Zahl elektrischer Lampen — eine Manipulation, die genau wie beim Gaslichte durch eine einzige Handbewegung bei einer einzelnen Lampe oder bei einem ganzen Lüster bewerkstelligt werden kann — der Strom zu stark geworden wäre, denselben sofort zu reguliren und dadurch jede Feuersgefahr zu vermeiden; andererseits sind an gewissen Stellen, den Straßenkreuzungen, den Ableitungen in die Gebäude und in deren einzelne Theile, die Kupferstreifen abgeschnitten und durch Bleistreifen verbunden, die bei einem plötzlichen Zunehmen der Stromstärke sofort abschmelzen und selbst wenn der Wächter seinen Dienst vernachlässigt hätte, den Ausbruch eines Feuers unmöglich machen. Zu all' dem kommt nun noch, daß die elektrische Beleuchtung genau um zwei Siebentel billiger kommt, als das Gaslicht. Die von Edison in's Leben gerufene Aktiengesellschaft gedenkt in Paris und in kurzer Zeit auch in Deutschland Zweigniederlassungen zu gründen und wird, wie ich aus bester Quelle weiß, in der Lage sein, in Paris den Preis eines elektrischen Lichtes bei normaler Gebrauchszeit auf fünf Franken monatlich zu stellen, während eine Gasflamme unter derselben Bedingung auf sieben Franken zu stehen kommt. Interessant ist, daß eine Berechnung, gefußt auf den Satz von sieben Franken monatlich für eine Gasflamme mit normaler Brenndauer, ergibt, daß das Kapital für eine Anlage mit hundert elektrischen Lampen, welches circa 14,000 Franken beträgt, in nicht ganz zwei Jahren amortisirt ist, eine Sache, die für alle außerhalb großer Städte gelegenen Etablissements von größtem Werthe ist und dieß umsomehr, als zum Betriebe der dynamo-elektrischen Maschine schon vorhandene Dampfmaschinen oder eine Wasserkraft selbstverständlich in Verwendung kommen können.

Wie ich sehe, bin ich fast gelehrt geworden, hoffe aber auf die Verzeihung meiner gütigen Leser, da Alles, was mit den großen Entdeckungen, welche uns die letzten Jahre auf dem Gebiete der Elektrotechnik brachten, zusammenhängt, sicher ist, das größte Interesse zu erregen.

1945

Wiener Allgemeine Zeitung. 4. Jänner 1882.

Wien bei elektrischer Beleuchtung.

— 3. Jänner.

Fee Elektricität hält triumphirend ihren Siegeszug über die civilisirte Welt. Daß sie eine große, eine bedeutende Zukunft habe, das konnte man ihr schon lange voraussagen. Aber erst in neuerer Zeit hat sich die mächtige Perspective auf diese Zukunft voll und ganz eröffnet. Das Unmögliche wird durch sie möglich werden, das Unwahrscheinliche ist durch sie bereits erreicht worden. Mit dem Telegraphen glaubte man ihre höchste Leistung erlebt zu haben. Da kam von jenseits des Oceans das Telephon, und man sah nun ein, daß die Elektricität noch lange nicht ihr letztes Wort gesprochen. Dasselbe Amerika, welches den Mann geboren, der dem Himmel den Blitz und dem Tyrannen das Scepter entrissen, es hat auch den Erfinder des Telephons hervorgebracht. Im Anfange schüttelte man in Europa über die Kunde vom Fernsprecher ungläubig den Kopf, und das Schlagwort: „amerikanischer Humbug“ ertönte, als gar von telephonischen Concerten die Rede war. Und jetzt! Jetzt klingelt fünf Schritte von unserem Schreibtische das Telephon; ein College aus einem Wiener Redactionsbureau hat uns etwas zu fragen, Eduard Strauß bereitet ein telephonisches Concert vor, und nicht mehr ferne ist die Zeit, da wir uns die „Rosen aus dem Süden“ oder eine Beethoven'sche Sonate in's Zimmer werden leiten lassen — namentlich für Musik-Kritiker eine entzückende Aussicht! Die elektrische Beleuchtung mußte sich ebenfalls in der Neuen Welt erst erproben, ehe sie in der alten zu Ehren aufgenommen wurde. Es scheint, als sei Amerika zur Versuchsstation für neue Erfindungen bestimmt ... Paris hat die elektrische Flamme von drüben herübergeholt, und im Jahre 1878 fand man dort zum erstenmal Gelegenheit, die Avenue de l'Opéra in elektrischem Licht erstrahlen zu sehen. Die ganze breite Straße entlang, von der Comédie Française bis zu der Großen Oper, herrschte Tageshelle. Die elektrische Beleuchtung fand von der genannten Avenue aus alsbald weiter ihren Weg, und sie wird einmal von ganz Paris Besitz ergreifen. Heute können wir uns kaum mehr in die Zeit hineindenken, da man ohne Eisenbahnen, ohne Telegraphen lebte. Klingt es uns nicht anekdotisch, daß Napoleon I., als er einen Courier nach Petersburg sandte, um dort sondiren zu lassen, ob er nach seiner Scheidung von Josephine auf die Hand einer russischen Prinzessin rechnen könne, erst nach sechs Wochen Antwort erwarten durfte? So werden spätere Geschlechter es wie ein Ammenmärchen anhören, daß ehedem Großstädte mit Gaslampen beleuchtet waren. Der Elektricität gehören die Jahrhunderte, die da kommen werden. Sie wird Aufgaben lösen, an denen bisher menschliche Kraft gescheitert; sie wird der Hexenmeister sein, den man allenthalben verbrennen wird, aber zur Beleuchtung, zur Erwärmung.

Wien ist nunmehr in die Reihe der Städte getreten, welche der Elektricität die ihr gebührende Ehre erweisen. Das Beleuchtungssystem Brush ist gestern in kleinem, heute in größerem Maßstabe erprobt worden. Heute Abends waren der Graben und der Stephansplatz elektrisch beleuchtet, und zeigten sich vorderhand noch Mängel, so darf man erwarten, daß diese mit der Zeit zu beseitigen sein werden. Das in Paris angewendete System Jablochkoff sowie das System Brush weisen dieselben Mängel auf: Ungleichmäßigkeit des Lichtes. Dieses flackert jetzt grell auf, um im nächsten Augenblick zu verdunkeln. Es fehlt die Ruhe, welche dem Auge wohlthut. Diese muß noch gefunden werden. Wer aus der Bognergasse auf den Graben trat, gewahrte heute die gerade Linie elektrischer Leuchtkugeln. Neun derselben sind in gleichmäßigen Abständen bis zum Stock-im-Eisenplatze postirt. Sie ruhen auf starken hölzernen Trägern, und von einer zur anderen zieht sich ein dicker Leitungsdraht. Mehrere sind direct neben Gas-Candelabern angebracht. Man findet also Gelegenheit zur Vergleichung. Das gelbe, matte Gaslicht verschwindet neben dem intensiven, in milchweißen Kugeln geborgenen, elektrischen Lichte. Das Wort „Taghelle“ war für heute übertrieben, aber man konnte immerhin in der Nähe der Leuchtkugeln Zeitung lesen, und die Züge der Passanten waren scharf erkennbar. Am Stephansplatz befinden sich vier Flammen, in der Jasomirgottstraße leuchtet eine, also Alles in Allem vierzehn. Besonders effectvoll wirken die zwei Flammen, welche die Façade des St. Stephansdomes erhellen. In elektrischer Beleuchtung trat das Schnörkelwerk unserer Kathedrale pittoresk hervor — die alte Metropolitankirche hat es sich wohl nicht träumen lassen, daß sie im neunzehnten Jahrhundert bei solcher Illumination ihre architektonischen Reize werde zeigen müssen! .. In der Jasomirgottstraße steht die Maschine. Sie hat ein improvisirtes, hölzernes Heim, aus dem nur der lange Schlot hervorsieht. Hoch steigt der Qualm empor, die Maschine summt und surrt; hineinsehen in das Häuschen darf Niemand, der Eintritt ist nur den dort Beschäftigten gestattet.

Den Abend hindurch war heute der Verkehr auf dem Graben und Stephansplatze lebhafter als sonst. Hunderte Menschen waren offenbar eigens herbeigekommen, um dieses Stück Wien bei elektrischer Beleuchtung zu sehen. Da gab es lebhafte Erörterungen pro und contra, die schlechten und die guten Witze flogen hin und her. Wien müßte nicht Wien sein, um bei solcher Gelegenheit nicht lustige Kritik zu üben ... Es spaziert sich recht angenehm bei der neuen Beleuchtung, und wird diese einmal definitiv eingeführt, so wird dies auf Wiens Nachtleben fördernd einwirken. Man weiß, wie nothwendig solche Einwirkung wäre. Die Wiener laufen gern vor der Thorsperre nach Hause. Vielleicht liegt — abgesehen von der ganz sinnlosen, zopfigen Einrichtung des Sperrgeldes — eine Erklärung darin, daß Wien keine gutbeleuchtete Abend-Promenade besitzt. Der Mailänder ergeht sich Abends in der Galleria Vittorio Emmanuele, der Brüsseler in der Galerie Saint-Hubert. Vielleicht wird der Wiener sich entschließen, die Ringstraße auch über 10 Uhr Abends hinaus promenirend zu benützen, wenn diese einmal elektrisch beleuchtet sein und der einzelne Spaziergänger nicht mehr spurlos im Halbdunkel verschwinden wird.

—s.

1946

Deutsche Zeitung. 4. Jänner 1882

Local-Nachrichten.

[Elektrische Beleuchtung.] Heute Abends waren der Stefans- und der Stock-im-Eisen-Platz, sowie der Graben probeweise elektrisch beleuchtet. Da indeß alle öffentlichen, sowie die zahllosen in den Geschäfts-Localen angebrachten Gas-Laternen brannten, läßt sich ein genaues Urtheil über die Wirkung der elektrischen Beleuchtung, wie dieselbe heute versucht wurde, nicht fällen. Im Ganzen brannten von der Rothenthurmstraße bis an das jenseitige Ende des Grabens dreizehn elektrische Flammen, die aber, wenn die Gaslichter gelöscht wären, kaum genügen dürften. Jedenfalls waren die zu dieser Probe verwendeten Säulen der elektrischen Lichter zu niedrig, da die Vorübergehenden Alle klagten, das Licht blende nicht wenig. Letzteres war übrigens ziemlich gleichmäßig.

1948 1947

Neue Freie Presse. 4. Jänner 1882.

Elektrische Beleuchtung auf dem Graben und Stephansplatze.

1949

Wien, 8. Januar.

Seit gestern finden auf diesen Hauptplätzen der City Probe-Beleuchtungen mit elektrischem Lichte statt, welche das Interesse des Publicums in hohem Maße anregen. Von allen Seiten der Stadt, ja auch aus den Vorstädten eilten die Wiener herbei, um das Licht der Zukunft, das einst der Gasflamme die Herrschaft rauben soll, zu betrachten. Der Gesammt-Eindruck der neuen Beleuchtung war ein sehr freundlicher; das elektrische Licht, welches man bisher nur in großen Arbeitssälen, in Bahnhofshallen oder vor öffentlichen Gebäuden concentrirt wirken sah, machte auf den Stadtplätzen minder intensiven Eindruck, veränderte jedoch die Physiognomie der Passage ganz erheblich zum Vortheile derselben. Der Anblick wäre jedenfalls interessanter und für eine vollkommene Beurtheilung maßgebender gewesen, wenn das Gas, das heute ebenfalls brannte, gänzlich verlöscht worden wäre. Das soll morgen (Mittwoch) der Fall sein. Heute sah man beiderlei Beleuchtungsarten neben einander, was einen zwiespältigen Eindruck machte. Das Gaslicht wird natürlich von der jüngeren, helleren Schwester sehr verdunkelt. Eigenthümlich war der Blick vom Graben zum Kohlmarkte und in die Tuchlauben, welch beide letzteren Straßen mit gewöhnlichem Lichte beleuchtet waren; sie erschienen heute im Gegensatze zu dem hell erleuchteten Graben ganz kleinstädtisch dunkel. Die promenirenden Städter sahen sich auf den elektrisch beleuchteten Plätzen erstaunt in die erhellten Gesichter, man erkannte sich schon aus ziemlicher Entfernung, und es zeigte sich, daß bei Einführung der neuen Beleuchtung das übliche Entschlüpfen im romantischen Halbdunkel ein Ende nehmen muß. Nach socialer Richtung mag auch noch die Bemerkung am Platze sein, daß geschminkte Damen, deren Antlitz auf der Straße sonst vom Gaslichte sehr gnädig behandelt wird, heute durch die rücksichtslose elektrische Lampe wie vom Tageslichte verrathen wurden. Der oft hervorgehobene Fehler elektrischer Beleuchtungen auf offenen Plätzen, der scharfe Schlagschatten, machte sich heute bei Straßenübergängen empfindlich geltend. Ueber die technische Seite des jedenfalls noch der Verbesserung fähigen Unternehmens erhalten wir von einem Fachmanne folgende Zeilen:

Die Gesellschaft zur Anwendung des elektrischen Lichtes System Brush hat, um ihr Licht dem Urtheile weiterer Kreise zugänglich zu machen, es übernommen, den Graben und einen Theil des Stephansplatzes, welche gegenwärtig ungewöhnlich reich mit Gasflammen ausgestattet sind, durch einige Zeit elektrisch zu beleuchten.

Nachdem gestern durch eine spät Nachts vorgenommene kurze Probe der ordnungsmäßige Zustand der gesammten Einrichtung constatirt worden war, wurde heute Abends die elektrische Beleuchtung dem regelmäßigen Betriebe übergeben und soll programmgemäß jeden Abend vom Eintritte der Dunkelheit bis Mitternacht, und zwar durch dreißig Tage, functioniren.

Die Quelle des elektrischen Lichtes bildet eine dynamo-elektrische Maschine, welche mit der zugehörigen locomobilen Dampfmaschine in der Nähe des Stephansplatzes auf einem verfügbaren Bauplatze in der Jasomirgottstraße aufgestellt ist. Von der dynamo-elektrischen Maschine führt ein einfacher blanker Kupferdraht von der Stärke eines gewöhnlichen Telegraphendrahtes zum Stephansplatze und über den Stock-im-Eisenplatz, Graben, Petersplatz und Bauernmarkt wieder zurück zur Maschine und bildet einen einzigen geschlossenen Stromkreis von 1 Kilometer Länge, in welchem sämmtliche elektrische Lampen eingeschaltet sind. Von diesen dienen dreizehn zur Beleuchtung des Grabens und Stephansplatzes, eine vierzehnte ist in der Jasomirgottstraße aufgestellt.

In dem Augenblicke, in welchem die Maschine in Gang gesetzt wird und den elektrischen Strom in die Leitung sendet, beginnen sämmtliche Lampen zu leuchten und erlöschen auch gleichzeitig mit Einem Schlage, wenn die Maschine abgestellt wird.

Der glänzende Volta'sche Lichtbogen, welcher zwischen den Kohlenspitzen in den Lampen entsteht, sendet ein Licht aus, welches unter dem mittleren Einfallswinkel eine Intensität von mehr als 2000 Kerzenlichtstärke besitzt und unerträglich wäre, wenn es nicht durch mattes Glas gemildert und zerstreut würde.

Die Kohlenstifte brennen acht Stunden; es ist aber jede Lampe mit einer doppelten Garnitur von Kohlenstiften ausgerüstet, welche sich automatisch einschalten, so daß die ununterbrochene Brenndauer einer Lampe 16 Stunden beträgt.

Das System Brush hat — von Cleveland ausgehend — in Amerika beinahe das Feld allein behauptet und findet seit Kurzem auch in Europa, insbesondere in England, rasch Eingang. Das Charakteristische des Systems besteht in der geradezu bahnbrechenden Anwendung hoch gespannter Ströme, welche es möglich machen, sehr viele Lampen — gewöhnlich 16 oder 40 bei größeren Anlagen — in Eine lange Leitung einzuschalten und mit Einer dynamo-elektrischen Maschine zu bedienen, wodurch die ersten Anlagen und der Betrieb sehr vereinfacht werden. Auch werden dem System Brush, welchem eine Reihe sinnreicher und praktischer Constructionen in der dynamo-elektrischen Maschine und den Regulatoren der Lampen eigenthümlich sind, als Vorzüge ein kräftiges und ruhiges Licht von weißer Farbe, ungewöhnlich lange Brenndauer der Lampen und insbesondere geringer Verbrauch an Kohlenstiften nachgerühmt. Obwol sich bei uns bereits mehrere andere ausgezeichnete Systeme von elektrischer Beleuchtung (wenigstens für industrielle Zwecke) Eingang verschafft und bewährt haben, so kann das Hinzutreten eines neuen bewährten Systems dem allgemeinen Interesse nur dienlich sein, welches in Allem „mehr Licht" von der Zukunft erwartet.

R. G.

1950

Neues Wiener Tagblatt.

January 4th 1882

1951

Der Stefansplatz im elektrischen Lichte.

Der Bischofspalast an der Ecke verblieb im Dunkeln, wie gewöhnlich; kaum daß ein Strahl des neuen Lichtes, das drüben, auf der anderen Seite des Platzes, zur Probe aufgezündet war, herüberglitt und den Versuch wagte, die Nachtschatten, in welche sich das massige Gebäude hüllte, zu bleichen und zu erhalten. Am Himmel aber, gerade oberhalb des Hauses, stand der Vollmond mit seinem, Jahrtausende alten, unabänderlichen Beleuchtungssystem — der richtige „aufgeklärte Konservative", der allerdings Licht verbreitet sehen will, aber nur das Licht, das er zu verbreiten für gut findet — mit dem breiten, feisten, selbstzufrieden unzufriedenem Gesichte stand er da und schaute verdrossen lächelnd nach dem Stefansthurm hinüber, dem zu sagen: „Alter Freund, nicht wahr, etliche hundert Jahre kennen wir uns schon und beleuchte ich dich schon und du warst immer mit mir zufrieden, und du fandest immer — und die Menschen unten bestätigten es — daß dir gerade mein Licht am besten passe und daß du gerade darin dich am besten ausnehmest. Wenn dann da unten noch ein paar Oellaternen brannten, so war das gerade genug, um die Gemüthlichkeit nicht zu stören. Aber dem lichthungerigen Volke behagte das auf die Länge nicht. Sie erfanden sich das Gas, um die Oellaternen zu ruiniren, und nun genügt ihnen auch Das nicht mehr und sie zwingen die Elektrizität, ihnen Lampenaufzünderdienste zu thun und verderben sich dadurch wiederum das Vergnügen an dem Gas. Schau nur hinab! Nehmen sich die Gaslaternen bei dem elektrischen Lichte nicht genau so aus, wie sich die Oellaternen bei dem Gaslichte ausnehmen mußten? Nicht zufrieden damit, daß ihnen die Nacht anständig beleuchtet werde, begehren die Menschen nun schon gar, daß überhaupt der Begriff Nacht aufhöre und von einem künstlichen Tag verdrängt werde. Was habe ich noch da zu thun?"

Und knurrig und murrig zog er eine graulich-weiße, dichte Wolkengardine vor sich zusammen.

„Daß der Begriff Nacht aufhöre" — wahrhaftig, das ist die Parole. Den Begriff des Raumes und der Zeit hat die Elektrizität bereits halb und halb zunichte gemacht, nun soll sie auch die sonstigen Eintheilungen der Natur korrigiren helfen und unser Auge aus der Nacht in den Tag hineintäuschen. . . . . .

Und auf dem breiten, von dem elektrischen Lichte streifenweise überflutheten Trottoir des Stefansplatzes, am Stock-im-Eisen und über den Graben hin, auf welchen ebenfalls die elektrische Lichtfluth niederging, drängten die Menschen einander, neugierig, zu sehen, wie sie sich des Nachts bei Tagesbeleuchtung wohl ausnehmen müßten. Man blieb gruppenweise stehen, man musterte einander, man experimentirte mit den Lichteffekten, nicht blos um zu probiren, ob sich Geschriebenes und Gedrucktes, sondern ob sich auch das Menschengesicht deutlicher lesen lasse. Für gar manches Gesicht, ja für eine ganze Klasse von Menschengesichtern, welche auf das wechselnde Licht- und Schattenspiel des abendlichen und nächtlichen Dunkels angewiesen sind, mußte die Einführung der elektrischen Beleuchtung geradezu eine Krise bedeuten — zum mindesten aber eine Revolutionirung der ganzen Straßen-Schminkkunst. Das waren kuriose „Anblicke", welche gestern das elektrische Licht mit seiner kalten Grausamkeit vermittelte!

Noch eine gelinde Revolution wäre unausbleiblich — in der Beleuchtung der „Auslagen". Viele der ausgestellten Kostbarkeiten in den Schaufenstern machten gestern nicht den halben Effekt, weil zwei kontrastirende Lichtströmungen gegeneinander geriethen. Da müßte durch andere Vorkehrungen die Harmonie des Lichtes gewonnen werden — aber eine verstärkte Wirkung würde alsdann nicht ausbleiben.

* * *

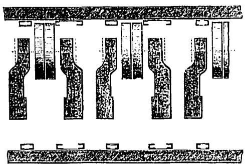
Der Wiener Gemeinderath hat bereits im Monate August der Kompagnie Brush die Genehmigung zur probeweisen Beleuchtung des Grabens, Stock-im-Eisen-Platzes und des Stefans-Platzes ertheilt. Die Probebeleuchtung soll einen Monat währen und erfolgt von der Gemeinde an die Unternehmer nur eine Vergütung, die dem Werthe des, an den bezeichneten Plätzen während der Monatsdauer konsumirten Leuchtgases entspricht. Mit der Aufstellung der Lampenträger wurde in der vorigen Woche begonnen, ebenso das Lokomobile, welches zur Krafterzeugung dient, zur selben Zeit in der Jasomirgottstraße nächst dem Stefans-Platze untergebracht. Für die Beleuchtung des Grabens wurden sieben, für jene des Stock-im-Eisen-Platzes eine und des Stefans-Platzes vier Lampen als ausreichend erklärt. Nachdem bereits vorgestern Nachts eine kurze Beleuchtungsprobe mit dem elektrischen Lichte stattgefunden hatte, wurde gestern Abends zum ersten Male die Beleuchtung für die Dauer bis Mitternacht begonnen. Der Eindruck des elektrischen Lichtes war sehr wirkungsvoll, doch würde ohne Zweifel sowohl die Intensität, als die Ruhe der Lichtkegel erhöht werden, falls der Betrieb nicht durch ein Lokomobile, sondern durch eine stehende Dampfmaschine erfolgen würde. Die durch das elektrische Licht glänzend erhellten Plätze der inneren Stadt könnten für die Zeit dieser Probebeleuchtung füglich des Leuchtgases entbehren. Es ist kaum einzusehen, aus welchen Gründen am Stefans-Platze und Graben die sämmtlichen Flammen der Gaskandelaber brennen, nach den Erfahrungen, die in anderen Großstädten mit der elektrischen Beleuchtung gemacht wurden. Zahlreiche Mitglieder des Gemeinderathes besichtigten gestern Abends die elektrisch beleuchteten Plätze und gaben ihrer Anerkennung über den günstigen Erfolg der Probe Ausdruck.

1952

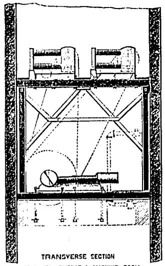
1953

THE EDISON LIGHT IN NEW YORK.

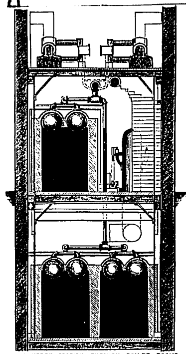
ON page 5 we give the first of a series of illustrations intended to show the system adopted by Mr. Edison in lighting large areas. He selects a central position whereon his steam motors and dynamo machines are placed, and from whence street mains radiate in the directions required. The sectional illustrations given in this issue almost explain themselves, but will be referred to when the system as a whole is described. Mr. Edison's representative in London, Mr. Johnson, is rapidly carrying out a similar plan to that adopted in New York, but on a smaller scale, in Holborn. The lights used in the City Temple, in the Holborn Viaduct Hotel, in the surrounding houses of business, and in the streets, will all be on the incandescent principle. The details of the system will be seen as we proceed with our illustrations.



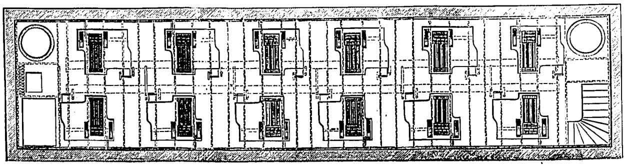
PART PLAN OF ENGINE FLOOR



TRANSVERSE SECTION THROUGH ENGINE & MACHINE ROOM SHOWING DRIVING BELTS

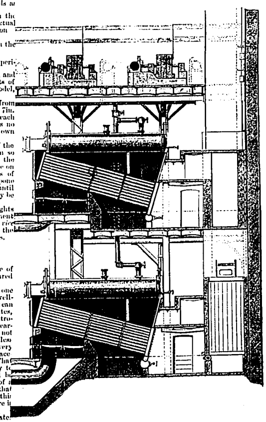


TRANSVERSE SECTION THROUGH BOILER ROOMS



PLAN OF MACHINE ROOM

PRODUCING ESTABLISHMENT.



FEET

THE EDISON LIGHT IN NEW YORK.

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1953

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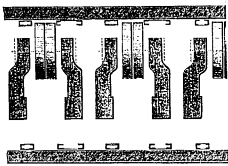

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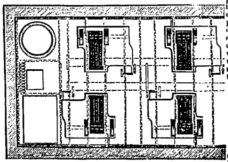
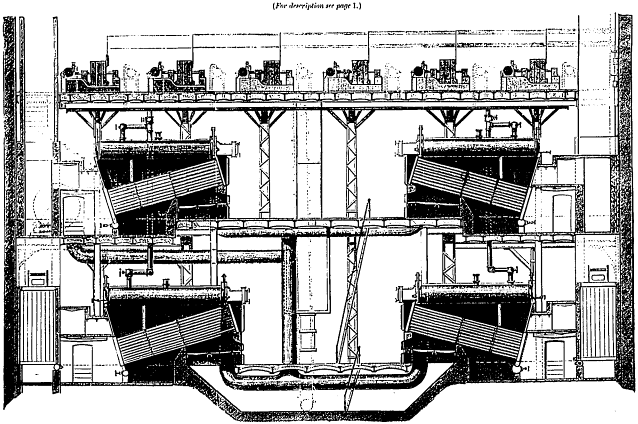


THE EDISON ELECTRIC LIGHT IN NEW YORK.—PRODUCING ESTABLISHMENT.

(For description see page 1.)



LONGITUDINAL SECTION

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[We do not ... correspondents.]

STRAINS ON CRANE POSTS.

SIR,—If you are not already tired out with the voluminous correspondence which has appeared under the above heading, I shou... feel obliged if you will permit me to air my views on the subj...

1954

ENGINEERING. [JAN. 6, 1882.]

THE ELECTRIC LIGHT AT THE SAVOY THEATRE.

The success of the illumination of the new Savoy Theatre on the Thames Embankment by Swan's incandescent lamps, installed by Messrs. Siemens Brothers, is likely to encourage other theatrical managers to follow suit. In that case the gain to the play-going public will be considerable; for the Savoy Theatre, thanks to the use of electricity, is perhaps the pleasantest and healthiest now in London. It is agreeably cool, the heat from the audience being apparently sufficient to temper the air, and there are no deleterious fumes of gas to give delicate people headache. The danger from fire is doubtless also lessened, for, as was demonstrated by Mr. D'Oyly Carte to a large audience, the breakage of one of the vacuum globes enclosing the white-hot filament of carbon is immediately followed by the extinction of the light. There are 1200 incandescent lamps in the theatre, including stage and auditorium. Every part of it is now lighted solely by electricity, green-room, dressing-rooms, bars, stage, and auditorium, if we except one or two gas jets kept burning in safe places to provide against any interruption of the electric current, and the limelight, which is employed to illuminate the performers when a tableau is formed. The harmonious colours of the æsthetic dresses in "Patience" show very well in the electric light; but it is perhaps too clear for the present mode of "making up" the faces of the performers, and this practice will have to be slightly modified, or in some cases discontinued. The acoustic properties of the stage are doubtless improved by the suppression of gas, a matter which is especially important in opera, and the stream of heated gases arising from the burning footlights can no longer act as an acoustic screen, to distort the music of a singer, or prevent him or her from coming to the front of the stage for fear of inhaling the hot fumes. It is a question, however, if a smaller number of large incandescent lights of the Maxim type would not be better behind the scenes than the hundreds of small 15-candle lamps of Swan, many of which did not yield more than 8 or 10 candles, and some even less. The 15-candle incandescent lamp is too small for the illumination of large spaces such as a stage; but on the other hand the arc light is too unsteady, and some intermediate light, of an incandescent type, giving a light of from 50 to 500 candles, would be desirable. The power to drive the six alternating current Siemens dynamos which yield the current is supplied by two Fowler engines of 16 horse power nominal; but as ten lamps are allowed to each horse power, they were probably working up to 120 horse power or 60 horse power apiece. They are stationed in a shed on some waste ground below the theatre on the Embankment, and it is, we understand, proposed to establish a central station there for the generation of electricity by like means, to supply the theatres and other premises of the Strand district with electric power.

1955

1956

1958 ... 1960 1961

Our correspondent, with reference to a recent controversy, telegraphs :—

The readers of this column will not have forgotten that some remarks of mine on the danger of touching electric wires called forth some interesting comments from "J. C. T." in two letters to the editor, which could not fail to impress those who read them with a sense of the ability of the gentleman who wrote them, and his familiarity with the subject of electricity. He was good enough to endorse the moral of my tale while correcting some misapprehensions of my own on the subject. I thought some of those corrections too sweeping, but, not being an electrician, believed discretion to be the better part of valour, and left "J. C. T." to wear his laurels. However, I thought the general subject of the danger of the electric light of sufficient public importance to make it worth while securing for the *Daily Free Press* some further information upon it. The following paragraphs on this subject I send with the authority of Mr Edison's representative in this country, Mr E. H. Johnson, who is now busy with preparations for the practical exemplification in this country of his principal's system of electric lighting :—

As bearing on the question of the danger of touching electric wires, Mr Johnson thinks that the recent correspondence in the *Free Press* might be advantageously supplemented if attention were directed to the difference between the electric circuit in which the earth is used as one conductor and a circuit wholly composed of wire. In the one case, there is but one wire, the earth acting as the return source. In the other case, there are two, and the earth is not called into play at all. Now, since the danger arising from contact of the human body with a wire carrying a current of sufficiently high tension to traverse the body is due solely to the fact that such contact supplies another channel through which the current can pass, it follows that the contact with conductors must be made at two places. Electricity can be no more made to traverse the human body from a single point of contact than it can be made to traverse any other conductor, only one end of which is in contact with the source of supply. When, therefore, there is a "metallic circuit"—that is, a circuit wholly composed of wire—there will be no circuit completed through the body unless one of the conductors is touched with one hand, and the other conductor with the other hand, or with any part of the body. When the earth is used as a return conductor, an individual standing thereon is, in effect, in constant contact with one of the conductors (just in proportion as the coverings of his feet may be good or bad insulators), and he has only to touch the wire conductor with any other one part of his body in order to complete the circuit through his body from the wire conductor to the earth conductor. There is greater danger in the single wire circuit, simply from the fact that we are a large percentage of our time, as it were, standing constantly on one conductor, and have only, therefore, to accidentally come in contact with the other in order to complete the circuit through us; while, with the metallic conductors, we must accidentally come in contact with the two conductors at one time before any harm can arise. A metallic circuit is, therefore, by far the safest to use, especially when the two wires run very close together—say two inches apart. In this case an accidental contact with them would more likely be effected through the hand or arm or other single section of the body than from one extreme of the body to the other, as from one hand to the other, or from the hands to the feet. The only result of such sectional contact would be a burn; to produce serious consequences the current must traverse the vital organs of the body. The explanation of the fact that workmen in shops may with greater impunity touch the single wire circuit than may persons standing on the ground is simply that they are insulated from the ground (the other conductor) by the dry wood or other materials of the building in which they are at work. If the building was itself iron, or the men stood upon a water pipe or gas pipe, and then touched the wire conductor, the result would be as disastrous as if they were standing upon the ground, for the reason that the circuit would be completed through their bodies to the gas or water pipe, and thence to the ground. Mr Johnson's opinion as to the golden rule is this—The golden rule for electrical engineers in handling wires in which such powerful currents are passing is to never by any chance permit their bodies to effect contact with the two conductors, whether they both be of wire or whether one of them be wire and the other the earth. The golden rule for the uninitiated is to never touch an uninsulated wire at all.

The safeguards to be adopted by the electrical engineer, and their application in the case of the Edison light, are thus explained to me by Mr Johnson :—The electrical engineer who will place the wire of a circuit in which the earth is used as a return in such a place or exposed manner as to permit of accidental contact with it by the uninitiated public, is not qualified for his profession, and should not be trusted with such work. The real safeguard against all such accidents is to use currents of low tension—so low, in fact, that if the human body should by any chance become the only channel for the passage of the current, a too infinitesimal portion would traverse it to produce any effect whatever. This safeguard is found in the use of what is called the multiple or parallel arc principle of connecting lamps—that is to say, the lamps are connected across from one wire to another of a metallic circuit after the manner of the rungs of a ladder. The tension required to overcome the resistance of a single lamp under such an arrangement is practically sufficient to overcome the resistance of any additional number that may be connected across the circuit—the additional electrical energy required by the added lamps being simply in the form of increased quantity, the potential remaining the same for the greater as for the lesser quantity. Unfortunately, this principle is only applicable to that class of electric lights known as the incandescent lamps. The arc light may not be so connected. It is necessary to connect arc lamps on what is known as the series principle—that is to say, direct in the line of the wire in consecutive order. The current passing through one lamp must have the tension requisite to overcome the resistance of that lamp. If a second lamp is placed in circuit, the tension must be increased in proportion to the increased resistance due to the addition of the second lamp; the third, still further increasing the resistance, necessitates a still further increase of tension; and so on, until a limit to the number of lamps that may be practically worked in a line is reached. This sometimes attains to the number of fifty, in which case a current of such tension has to be used as to constitute it a source of great danger. Thus, currents of such tension are necessarily used with the arc lights, while they are not necessary to incandescent lights, and, in point of fact, should never be used with the latter. To the fact that a number of Swan lamps were so connected at Hatfield House is due the death of the labourer. Had they been connected in parallel arc, as they should have been, no such accident would have been possible.

1959

LATEST INTELLIGENCE.

(FROM OUR CORRESPONDENTS.)

(BY TELEGRAPH.) 1962

FRANCE.

PARIS, WEDNESDAY, JAN. 4.

M. Proust opened to-day, at the Conservatoire des Arts et Métiers, the Commission of inquiry into art industries and artisans. He dwelt on the foreign competition now threatening such industries, on the apprehensions expressed as early as 1826, but not seriously considered till after the London Exhibition of 1851, on the absence of any State action, and on his intention of submitting a Bill for extending and improving instruction in drawing. The Commission, he said, would ascertain the effect of the substitution of large factories and the infinitesimal division of labour for small workshops with but few apprentices. He commended the example set by the jewellers in creating schools which give an idea of the manufacture in its entirety, and advocated the appointment of sub-commissions to deal with particular localities or industries. The Commission resolved on inquiring first of all into wood carving, &c., and numerous offers of specimens have been made to it.

At the preliminary meeting yesterday of the Society for the Utilization of Electric Force, M. Bontoux, who presided, delivered one of those speeches in which he excels. Whether his ideas are sound or not he has a fascinating way of expressing them and it seems a pity that he cannot devote himself exclusively to oratory, for he has a knack of summing up a thing, however dry, in telling phrases. Yesterday, for instance, he remarked :—

"The really aristocratic machinery, still almost intact, the employer's real privilege in the working world, is motive power. The artisan, who needs a little motive power for his work, is forced to seek it in the employer's factory, while thousands of workmen and workwomen wear up their bodies and destroy their strength in impelling the sewing-machine, the lathe, and the other motive powers of small industry. The division of electric energy is destined to effect an entire revolution in this sphere. The day will come, and sooner than is imagined, when the artisan family will see enter their dwelling by means of a magic wire the force which is now so costly to them, and this will be the democratization of force for the benefit of the working class."

This last phrase is a striking one, and foreshadows the solution of a difficult social problem. It points to the enfranchisement of the artisan, wherever individual can be substituted for collective toil, from the dependence imposed on him by the absence of motive power. Whenever the artisan, having motive power at home, can work surrounded by his family and training his sons, thus escaping from the contamination of the workshop, from the influence of the wine shop, and from hurried and innutritious meals ; whenever his daughters can work at home instead of in women's workrooms—far more demoralizing than men's workshops—a great step will have been taken towards the solution of the labour question. It would be a piquant thing were the so-called Catholic, or Reactionary, Bank to promote this transformation, fatal to empty demagogues ; but the solution of the problem will certainly be a philanthropic achievement. The system of transmission of force to be worked by this company is that of M. Marcel Deprez, who took the chief prize at the recent Electric Exhibition.

M. Hérold was buried to-day, according to his special directions, without religious rites of any description. His funeral was attended by a large number of persons officially and otherwise identified with the Republic.

A Professorship of Nervous Maladies has been established at the Faculty of Medicine, and conferred on M. Charcot, hitherto Professor of Anatomy, who has of late years made a special study of nervous phenomena.

The Dominicans have just sold their monastery in the Rue Jean de Beauvais, one of the establishments closed last winter.

THE MORNING ADVERTISER,

Jan. 5/82

1963

THE ALLEGED DANGER OF ELECTRIC LIGHTING.

TO THE EDITOR OF THE MORNING ADVERTISER.

SIR,—The late unfortunate occurrence resulting in the death of an employé at Hatfield House, and the numerous well-authenticated instances of similar accidents caused by electricity, together with the accentuation of fear produced by the lamentable calamity at Vienna, having provoked a discussion as to the increment of danger to life and property from the general introduction of the electric light, it has occurred to me that the time is opportune for someone to endeavour to dispel the halo of mystery with which electrical action and effects are surrounded, and to plant in its stead a sense of the mastery over the power which it is perfectly easy for the general public to possess. The exceeding simplicity and tractableness of electrical energy once recognised will, in my judgment, place in their hands the means of defence, both as against the agency itself and the neglect or ignorance of workmen. Had the noble lord whose employé met so untimely an end possessed a proper appreciation of the fearful power of the particular electrical current passing in the wires which fed his lamps, he would never have permitted their being placed unprotected upon a garden wall within easy reach of even a child. May I, in view of this condition of the popular mind, beg the use of your invaluable columns for a few remarks illustrative of the fact that the safe and harmless transit of electrical energy is but a simple engineering problem within the compass of ordinary intelligence, and therefore permits everyone to exercise the same intelligent precautions in applying it as they would in the application of steam or gas? It is true that since we do not know what electricity is, we are apt to endow it with a mysterious power, only subject to the control of the magic wand of great scientific knowledge. This is the natural result of poetic fancy and false teaching, and should be eradicated root and branch ere the application of this handy and withal plain, prosaic servant of man becomes more extended.

Let us examine it from this point of view and see if it may not become as completely our servant as is steam, gas, or water. 1. We know that electricity is simply a form of energy ; 2. That we can create it at will by effecting certain combinations of dynamic and magnetic or chemical forces ; 3. That we can create it in any desired quantity and under any desired degree of pressure ; 4. That we can convey it from the source of its supply to the point of demand ; 5. That we can there translate it into other forms of energy, as, for instance, heat and light, or the energy of motion. In all these respects it is analogous to gas. Since, however, it differs wholly in character, it demands different treatment in the various details of its management. It is created and transmitted from the source of supply to the point of demand practically instantaneous with its consumption, that is to say, if it is not being utilised it is not created. The quantity so created and transmitted is invariably in direct proportion to the amount consumed. It becomes, therefore, simply a question of determining how much is requisite to the performance of the required work, and to then provide a medium of conveyance ample for its transmission. The conducting medium is a metal wire, and must be continuous from the source of supply to the point of consumption and back to the source of supply. Unless this circuit is complete no electricity will pass from the source of supply. The two wires thus used become the counterpart of the steam or gas pipe, and whenever or wherever they may be collectively tapped electricity may be drawn off ; that is to say, join these two wires together at any point throughout their length by any material capable of conveying electricity, and electricity will pass through such material from one wire to the other. Now, as the human body is a conductor of electricity, it follows that if this junction is made through it, electricity is passed through the body, producing therein heat of a greater or lesser degree, according to the pressure electricity is under. If, as is frequently the case, the earth is used as the return wire a junction is effected by contact with the outgoing wire and the earth. Hence as we walk upon the earth it follows that we are, as it were, constantly in contact with one wire and have only to effect contact with a single other wire in order to receive through our bodies a quota of the electrical energy happening at the time to be active on the wire. The use of a return wire instead of the earth largely lessens the chances of our accidentally effecting this junction, and is therefore recommended. The size of the wire requisite to convey the electricity is regulated by the pressure and the amount required and the metal used, and is determinable by well-known mathematical formula. The wire being usually made of copper, and that metal being of considerable value, the tendency is to increase the pressure in order to convey the required quantity through a smaller wire. The tendency is pernicious, but inevitable. If the wire be inadequate it becomes heated, in which case there is danger of fire. A wire should, therefore, have rather more than less carrying capacity than is demanded by the normal energy conveyed, in order to provide for any accidental abnormal increase (a very possible contingency). Fifty per cent. is a safe margin, since we can increase the quantity of energy generated, and therefore transmitted, by supplying additional or better means for its passage from one wire to the other. It follows that the accidental junction of the two wires, either by means of a third piece of metal or by actual contact as between themselves, will effect an abnormal increase of energy ; consequently as such accidents are always possible, the contingency should be provided for. The means employed to prevent such accidental junctions are twofold—viz., actual aerial separation of the two wires, and enveloping them with a non-conducting material—that is, a material through which electricity will not pass. When properly divided with such an envelope the wires may be bunched together or handled with impunity. The sufficiency of this envelope, which is termed "insulation," therefore becomes important ; the material of which it is composed should possess three properties. First, it should be a non-conductor of electricity ; second, it should be non-inflammable ; third, it should be of such tenacity as to resist abrasion whether by momentary or long-continued blows of friction. It will be seen that this insulation, like the iron of the steam pipes, confines the energy within its interior. The fact that we have in one case a solid substance and in the other simply an air space as a channel for energy transmission does not affect the question of its value or importance. The envelope, therefore, becomes a matter of great moment, especially in respect of the first requirement—viz., impenetrability. All materials are more or less conductors of electricity, therefore even when that offering the greatest resistance is selected, its thickness should be varied according to the pressure of the energy, precisely as the resistance of a steam pipe would be varied in accordance with the steam pressure. And, again, in respect to the second requirement. As an abnormal increase of the quantity of electricity is possible, and when produced is capable of effecting an abnormal heat in the conductor, the insulating envelope should be composed of a material not readily affected by heat, in fact, it should be non-inflammable. Now, as most of the well known insulating compounds are either inflammable or readily reducible to a liquid state by the action of heat, They are not reliable, and should not be used, especially as materials possessing the requisite dual resistance to electrical escape and combustion are obtainable, and are in extensive use. Given a material possessing these qualities, it should be so woven upon the conducting wires as to present a hard and tenacious surface capable of withstanding wear and tear. An insulation of this character affords a reasonable safeguard against accident to life or property, but even the efficiency of such an envelope may become affected by time. A wise precaution, therefore, is to cover the conductors wherever exposed with a shield of wood or other substantial material.

In addition to the above precautions, however, Mr. Edison has supplied us with another of novel character, and which offers absolute protection against an abnormal increase of energy. In each and every branch of his system of conductors he inserts a short piece of metal (usually lead), having a very much lower fusing point than that of the copper of the conductors ; the energy thus traverses the lead and the copper conductors in a common path, and in the event of sudden increase the lead fuses, all electricity in that particular branch is withdrawn in the twinkling of an eye, and thus the conductors at the point of accidental contact become so much dead matter incapable of doing mischief.

As is seen, the function of pressure is to effect economical transmission. The cost of a conductor for steam, gas, water, &c., being simply the cost of the envelope, it follows that an increased quantity may be transmitted to a certain point in a given time by simply increasing the size of the envelope. Hence these forms of energy may be transmitted in great quantity under very low pressure, with little increase of investment in the conducting medium, whereas the problem of economy in transmitting electricity is materially affected by the size of the conductors. These conductors being of a costly material, the tendency is to transmit electrical energy under very high pressure through a small conductor, in order to deliver a given quantity in a given time ; whereas if it were not for this question of economy the size of the conductor would be increased, so as to transmit the requisite quantity in the same time under a lower pressure as is done with the forms of energy above cited. Since, however, the application of electricity for general domestic use must not be accompanied by the introduction of a new element of danger, the part of wisdom is to adopt low pressure, and employ such means as may be necessary for its utilisation. When high pressure is used the lamps are connected in the line of the circuit in consecutive order, like the links of a chain, so that their combined resistance may be proportioned to the pressure of the energy acting upon them, otherwise they would be destroyed. The failure of any one of these lamps, it is apparent, will destroy the continuity of the circuit, and the "chain" will give way : thus we have another reason for not using our energy at high pressure, inasmuch as it necessitates a system in which dependence is placed upon a single thread for the whole supply of light ; or, in other words, our lamps have no individuality. This is unfortunately a necessity with that class of light known as the arc light, but it is not only unnecessary, but contrary to practical engineering to so connect incandescent lamps. With the latter it is quite practicable to utilise the energy at low pressure, and at the same time to give absolute individuality to each lamp, so that one may be controlled independently of the others. The method of connecting the lamps for this purpose may be illustrated by assuming that the two conductors represent the sides of a ladder, the rungs of which represent the lamps ; the circuit from the source of supply is thus complete by one conductor to each lamp, and through it to and back to the other conductor. The pressure requisite in such an arrangement has to be sufficient merely to overcome the resistance offered by one lamp, but the quantity of the energy must be sufficient to supply the number of lamps placed across the conductors ; the pressure, whether one lamp is used or 1,000, practically remains the same. Since the resistance of the human body is so enormously in excess of one of such lamps, it follows that the pressure is insufficient to overcome it, and as the pressure is insufficient to cause the current to traverse the body the quantity of current that may be present is immaterial. Therefore, so far as life is jeopardised by the introduction of electricity, this system is without the smallest objection, while in the other system immunity from danger is only secured by absolute prohibition of contact as between the body and the wires. In respect to the danger from fire so far as the transmission of energy is concerned, there is but little difference between the two systems. The arc lamp, of course, as a lamp, is more liable to produce fire than the incandescent lamp, for the reason that in the former there is actual consumption in the open atmosphere, while in the latter there is no consumption, and the heat, infinitesimal in degree, is confined within a sealed glass bulb, the breaking of which would instantly eclipse the light. In respect to transmission, energy of high pressure is obviously more likely to penetrate the insulating envelope and thus escape to the other conductor and produce abnormal heat in its path, and consequently fire, than

energy at low pressure. Only in this respect, however, is there any difference between the two systems in the matter of producing fire. The low pressure energy, if given a low resistance path by the accidental contact between the two conductors, will develop an amount of heat sufficient to fuse the conductor, destroy the insulation, and produce fire. The problem of providing safeguards against such abnormal increase of energy is, therefore, almost as important in the one system as in the other. As to which will permit of the most reliable treatment in respect of such provisions, I think there can be but little question, and I trust I have sufficiently shown that simple and efficacious means are provided and are at our disposal which may be readily comprehended and applied by any engineer.

I am, Sir, yours obediently,

EDWD. H. JOHNSON,

Manager, the Edison Electric Light System.

57, Holborn-viaduct, E.C., Jan. 4.

RECENT WONDERS OF ELECTRICITY.

#1964

Mr. W. H. PREECE, F.R.S., gave a second and concluding lecture on this subject yesterday evening before a numerous audience, which filled the great room of the Society of Arts, John-street, Adelphi. Recapitulating the heads of his previous lecture, he said that one of the principal objects he had in view was to disabuse the minds of his hearers of the idea that electricity was a fluid or any tangible form of matter. It could be spoken of as a distinct entity in the same manner as heat, light, or sound was spoken of, without any sensible existence being implied; but all its effects, as indeed all physical phenomena, were forms of energy. Energy was as much entitled to reality as matter. Like matter, it could neither be created nor destroyed. Human power could only transform and apply some available store of it to useful purposes. Wherever a current of electricity was produced energy was expended and work done; and energy expended at one point of a system must appear in some form or other at another point. In the last lecture electro-magnetism was shown as a form of energy, and the lecturer now showed that when electricity was driven through a chemical compound, in solution or liquid, its action was to break up the compound into its constituent parts, and the weight of the material decomposed per minute was an exact measure of the work done or of the current passed. Water, for instance, was broken up into its elements, oxygen and hydrogen, sulphate of copper into sulphuric acid and copper, and nitrate of silver into nitric acid and silver; hence the practical application of electricity to electrotyping, electro-plating, and nickel-plating, which processes were illustrated. When electricity was transferred through solids the work done appeared as heat, and a definite amount of heat appeared for every unit of energy expended, and its temperature varied with the resistance to the passage of electricity. All substances, on being heated to a temperature approaching 1,000 deg. Fahrenheit, began to emit light, commencing at a dull red glow and advancing to 2,300, when the sustaining power of carbon was reached, and the result was a rupture of the conducting material. This variation of light and heat formed the subject of some beautiful experiments. Fine wire, of platinum or iron, was shown to become intensely heated when electricity passed through it, and this effect was utilised in electric fuses for blasting purposes in mines, discharging torpedoes at a distance, firing broadsides on board men-of-war, and other practical applications. Some admirable experiments prepared for the lecturer by Professor Abel, C.B., illustrated that branch of the subject. The work done by electricity in its passage through air and gases, the lecturer went on to say, appeared as sparks and light. Sparks were due to matter rendered incandescent by the high temperature produced. Some beautiful effects through vacuum tubes, by induced currents from a large induction coil, were shown, which led up to the electric light, for which greater currents of electricity were required than had yet been shown. It was necessary to call in the aid of mechanical power to produce the currents employed for this purpose, and the steam-engine or water power was brought into requisition. The motive force was simply the motion of a conductor through a magnetic field, and the greater the intensity of the magnetic field, and the greater the velocity with which the conductor cut the field at right angles to its lines of force, the greater was the current produced. Magneto-electric machines were those in which the field was produced by permanent steel magnets; dynamo-machines were those in which the field was produced by an electro-magnet excited by the current which itself produced by a kind of accumulating action. In each case the current was the result of the mechanical work expended, and, with the exception of that portion necessarily wasted in friction, was an exact measure of the horse-power exerted. Such powerful currents were utilised in "arc" electric lamps, where rapid sparks were passed through air between two rods of carbon which were disintegrated and rendered highly incandescent; or in "incandescent" lamps, where they passed through solid carbon filaments, which became raised to a very high temperature, and therefore gave a brilliant light. The hall was again lighted by Edison incandescent lamps. It was then explained that the action of magneto or dynamo-machines was reversible, and that the currents from the first machine would cause a second similar machine at a distance to be driven in the opposite direction; hence the applicability of electric currents to the driving of cars on railways, to ploughing land, to boring rocks, to printing, to sewing-machines, to ventilation, to wood carving, and to various industrial and useful purposes, as was illustrated at the recent exhibition in Paris. The lecturer remarked in conclusion on the beneficial influence of that exhibition, on the progress of electrical applications, and of that about to be held in the Crystal Palace, and observed that while some people spoke of electricity as a mysterious agency, and a wild, untamed beast, it was only mysterious to the ignorant and untamed to the unskilled. It was an obedient slave to the experienced, but it was a very dangerous ally to the careless.

An electric light chandelier manufactured by Messrs. B. Verity and Sons, of King-street, Covent-garden, which formed part of the illuminating apparatus, was much admired for its beauty of design and general effectiveness.

1964

Charles Batchelor Scrapbook, Cat. 1327

This scrapbook covers the period January-December 1882 and contains clippings about electric lighting. Included are articles about the Paris Electrical Exhibition of 1881 and about Edison's work in electric lighting in the United States and Europe. Other articles deal with the Holborn Viaduct central station in London, the opening of the Pearl Street station in New York City, the formation of Edison light companies in France, and the establishment of isolated lighting plants in the United States and Europe. Included also is a technical drawing by Batchelor. Some of the clippings are in French and Italian. The spine is labeled "1882" and "1955 2231". The book contains approximately 200 unnumbered pages. The clippings are individually numbered 1955-2231.

1965

THE TIMES, MONDAY, JANUARY 9, 1882.

THE INTERNATIONAL ELECTRICAL EXHIBITION.

W[illegible] announcement was first made that an international [illegible]hibition of electrical machinery and apparatus was to be held at the Crystal Palace it was coupled with the statement that it would probably be opened during the month of December last. Those who expected this to have been the case could hardly have taken into consideration the time which must necessarily be occupied in fitting and fixing the machinery and apparatus, some of which is of a very heavy nature and requires solid foundations, or they would not have hazarded such a statement. Moreover, they [illegible] have remembered that a considerable proportion of [illegible]ibits had to be taken down and removed from the [illegible] Paris Exhibition and refixed at Sydenham, which [illegible] of time and has helped to retard the proceedings at the latter place. Another element of delay has been the circumstance that in many instances improvements have [illegible]ected upon the apparatus as shown at Paris, and [illegible]ese have required time to work out and put in [illegible] shape, so that the appliances could not even be t[illegible]red from Paris to Sydenham direct, as it was at one [illegible] thought they could be. Hence, from one cause or anoth[illegible], the display at the latter place is at the present time far [illegible]om being complete. About 400 allotments of space have b[illegible] made, but up to the present time only some 50 exhibit[illegible], or 12 per cent., have put in an appearance, [illegible] of these on[illegible] a very few have their stands re[illegible]. This is exclusive of those exhibitors who have unde[illegible] to illuminate portions of the Palace, the greater number of whom are more or less forward with their wor[illegible], one company has, in fact, started lighting up at dusk. A strong hope is entertained that everything will be ready and the exhibition in perfect working order by the 14th inst., and every one is endeavouring to bring about this result. A recent visit to the exhibition, however, [illegible] this can hardly be the case, seeing that [illegible]ount of heavy driving machinery has yet to be d[illegible] and erected with all the care and circumspection [illegible]manded by electrical apparatus, and seeing, also, that [illegible]me 350 exhibitors have yet to fit up and arrange their stands. It is, however, not at all improbable that by the [illegible] of the present month a really attractive display wi[illegible] made, and the greater portion, if not the whole, of th[illegible]ilding el[illegible]trically illuminated.

[illegible] however, as the exhibition is at present, one [illegible] lighting, as we have stated, has been [illegible] suff[illegible] advan[illegible] been made with others to enable us to give an idea of what will be seen when the whole has been completed. [illegible] may premise that the electric lighting of the building will be effected by means of several systems, to each of which a portion of the Palace has been assigned. Commencing with the northern end of the building, we have first the tropical department and the Byzantine and Alhambra Courts, by which it is flanked on th[illegible]tively. These have been assigned to [illegible] Electric Light Company, who will [illegible] arc light alone in the tropical department and the Byzantine Court. The Alhambra Court will be illuminated by means of a one arc light in the centre and [illegible] number of the Lane-Fox incandescent lamps placed under the surrounding arches. The aquarium is also to be lighted with Lane-Fox lamps by this company. The engines and machines for producing the current will be placed in a large annexe at the north-western angle of the tropical department. They will consist of seven steam-engines of about 150-horse power collectively. Five of these will be Robey engines, one of which, of 25-horse power, is in place. The remaining two will be by other makers. These engines will drive 13 dynamo-electric machin[illegible] [illegible]m 16 to 40 light capacity. The north end of [illegible] the Mediæval and Roman Courts are illumin[illegible] [illegible]ery evening by the Electric Light and Power Generat[illegible] Company, who employ for this purpose 18 arc light[illegible]. [illegible] machinery is placed in what is known as "The Tunnel," which is [illegible] corridor running north and south under the Palace on the eastern side. They have a semi-fi[illegible] engine of 20-horse power, by Messrs. Ransomes, Head, and Jefferies, which drives two Weston dynamo machines, each supplying a circuit of nine lights. Two more machines are to be added, which will supply the current to a number of Maxim incandescent lamps. A fifth machine will [illegible] be in position for supplying an "[illegible]," designed by this company. This consists of an arc lamp placed in the focus of a silvered reflector, and which is for use at sea for detecting the approach of torpedo boats at night. This lamp is to be placed on the roof of the Palace, and it is stated that it will project a bright light a distance of three miles.

Next in order come the British Electric Light Company, who will illuminate another portion of the nave, the Egyptian Court, and the one opposite, by means of the Brockie arc lamp. For this purpose they will have in the Tunnel three engines, by Messrs. Marshall, Sons, and Company, two being of their portable and one of their semi-fixed type. They will also [illegible] three of Hodgson's rotary engines and one gas engine, [illegible] altogether about 150-horse power nominal. This company will use [illegible] own dynamo machines, of which there will be from 25 to [illegible] of various powers. Adjoining this stand is that of the Edison Company, who will probably make the most varied and extensive display in the Palace. They will have three Robey engines of 25-horse power each, which will drive 12 60-light Edison generators, each light being equal to 16 candles. This plant and machinery represents in miniature Mr. Edison's system of central distribution. It is so arranged that any two of the machines can be thrown out of work without affecting the steadiness of the remaining lights. With this apparatus will be lighted, by means of Edison [illegible]andescent lamps, the concert-room, the stalls and buffet [illegible] the centre transept, and the entrance to the High Level Railway Station. The large entertainment court on the western side of the south nave will also be similarly lighted, and will be otherwise wholly devoted to Edison exhibits. It will be illuminated by means of a central chandelier and a number of brackets on the walls, and will contain examples of all Mr. Edison's inventions, including the phonograph, the telephone, and a variety of electrical apparatus. Close by the Edison stand in the Tunnel is that of the Electric Light and Engineering Company, who have one of Messrs. Ransomes, Head, and Jefferies's portable engines, which will drive a coup[illegible] of dynam[illegible] machines fixed on a plate attached to the [illegible]ont of the engine. Of these machines, one, which is fixed in place, is a Siemens dynamo, while the other will be a Gramme machine, and with them the company will light up the main entrance to the Palace on the garden terrace. The centre transept of the Palace, which includes the orchestra and the theatre where the pantomime is at present being performed, will be illuminated by the Crompton light, of which the only outward and visible signs at present are some cords and wires suspended from the roof at intervals. The electrical machine and the engine for driving it will be placed in a gallery on the ground floor on the western side of the south nave, where a large amount of spinning machinery was located during the late Woollen Exhibition. In this gallery, also, will be placed the engines, chiefly gas-engines, for driving other machines for lighting purposes. Here Messrs. Strode and Co. already have an Otto gas-engine of 12-horse power, with which they will drive four Siemens dynamo machines for supplying the current to four arc lights in the south nave and 20 Lane-Fox incandescent lamps. The arc lamps, in fact, are already in position. They will light that portion of the nave to the south of the transept. Messrs. Strode will also exhibit a system of gas-lighting by electricity at their stand in the gallery, where will likewise be placed the Lane-Fox lamps. No provision has at present been made for electrically illuminating the remaining portion of the south nave, but it is thought probable that it will eventually be lighted upon the Siemens system. In the gallery to which we have just alluded several gas engines are being laid down and there are indications that the Jool and Pilsen, the Gravier, and other systems will be exhibited in operation. The Opera Theatre, one of the galleries, and the Low Level Railway Station are to be lighted by the Compagnie Générale d'Electricité upon the Jablochkoff system. The machinery will consist of two Gramme machines, one being driven by an Otto gas-engine of 12-horse power and the other by one of Hindley's steam-engines of 10-horse power. These will supply the current to the Jablochkoff lamps in the Opera Theatre, while that for the lamps in the railway station will be supplied by one of Messrs. Marshall's 10-horse power portable engines. On the left of the long stretch of corridor leading from the Palace to the Low Level Railway Station is a large annex in which Messrs. Hammond and Co., are laying down engines and machinery for lighting the whole length of the corridor, a portion of the technological museum, and one of the courts in the Palace. The machinery will consist of three semi-fixed engines by Fowler; Davey, Paxman and Co.; and Hornsby respectively, those by the two last-named makers being already in place. There will also be a gas-engine by a new maker. These engines will drive four Brush dynamo machines, which will supply the current to the lamps.

. . . .

We have thus 12 separate installations of electric lighting which have been, or are being, arranged for, and the machinery and apparatus for which, with one exception, is in course of being laid down. That exception is the Electric Light and Power Generator Company, who have got to work in lighting their allotted portion of the north nave and the two adjacent courts. When the whole 12 demonstrations are complete and in working order there can be no question that a magnificent display of electric lighting will be witnessed at the Crystal Palace. It will, perhaps, be difficult to form a conclusive opinion as to the merits or demerits of those systems which will be working in contiguity in the nave, except there be some glaring deficiency or palpable superiority present in one or other of them. Where the systems are isolated, as in some of the courts, the difficulty will be greatly reduced, if it is not altogether obviated. With regard to the stands of the exhibitors generally, their backward condition renders it desirable that a notice of them should be postponed. We shall therefore return to the subject when some further advance has been made both in respect of the general exhibits and of the electrical illumination.

1966

1967

CHAS. BATCHELOR.

1969

THE INSTALLATION OF THE EDISON LIGHT IN NEW YORK.

1970

DISTRICT LIGHTED IN NEW YORK BY Mr. EDISON.

Herewith we give a plan of the part of New York to be lighted by Mr. Edison. The numbers represent the number of lamps wired in each block, and the horse-power to be transmitted to work hoists, lifts, &c. This is but the first of a series of illustrations we intend to give to show the details of the whole installation.

THE MORNING ADVERTISER, JANUARY 10, 1882.

1975

The very interesting statement which appeared in our columns recently over the signature of EDWARD H. JOHNSON, will no doubt remove the exaggerated apprehensions existing with respect to the perils of electricity. It is not surprising that these apprehensions should exist. Mr. JOHNSON shows incidentally that the nature, attributes, and action of the electric light are not a mystery only to the multitude, but are hidden from the higher intelligences of the age. There is not an old mythus or an allegory of the ages of the gods but has its parallel in some achievement or some marvel of modern science. When FRANKLIN brought the lightning upon the spike of his kite he realised the fable of Prometheus. The electrologist is he who satisfies the command of the stern philosopher mentioned at the Chuzzlewit levée by Miss Toppitt, the lady in the wig, as crying amid the howling of the sublime, "Arrest for me that agency; go, fetch it hither!" It is a little over seventy years since the agent was first exhibited in his habit as he shines. Light from battery electricity was first discovered by Sir HUMPHRY DAVY, at the Royal Institution, London, in 1810. The day seems now at hand when this mighty force, with its boundless possibilities, will be fairly pressed into the service of man. We are, it may be, nearer than we think to the time so confidently predicted by enthusiasts, when not only our dwellings, our streets, our railways, and even our highways will be lighted by electricity, but this latest of the ministering angels of civilisation will supply the motive element of travel and transit by sea and land, will warm our cities by wholesome heat, and will even perform the office of sun and light upon our crops. This is a magnificent future, which may be near or far. In the meantime, however, we have but partially reached the smaller and simpler of these grand attainments. The lighting of our thoroughfares and houses is still but an experiment. Even in America, where it is being tried on a larger scale than with us, it is employed only here and there in a few towns throughout the Union. It seems only yesterday since the EDISON scare sent down gas shares all over Europe. Since then a host of rivals and imitators of the inventor of Menlo Park have been hard at work. The sum total of their labours does not amount to a solution of the question in all its essentials; but those who visited the late display of electric lights in the Palais d'Industrie in Paris must have formed an opinion—which is pretty certain to be shared by those who may see the exhibition at the Crystal Palace—that, at least in this branch of it, we have as good as plucked out the heart of the mystery.

The electric light has had to fight its way against a good deal not only of unfavourable but of unfounded criticism. It was said to be objectionable from a festive as well as from a sanitary point of view. The same ray which was declared to poison the atmosphere was said to be destructive to the complexion. We were told that it would not only swell the death rate, but that it would give the living green and horrible complexions, and quite transform drawing-room beauty into ugliness. It has outlived these calumnies. The electric light, we now know, does not affect the atmosphere so unpleasantly as other artificial lights do, nor does it injuriously affect what OTWAY's orphan would call "a set of features or complexion." But the still more serious charge still clings to it, and, it must be said, has been justified to a certain extent by more than one fatality. It is said to be dangerous to life. We have seen that it is so. The instances are more than that latest and most remarkable of them—the death of a young workman at Hatfield House, by coming in contact with a conducting wire. The young man, it will be remembered, laid his hand on the wire, and was killed instantly, the electric current striking him dead in the same way as a flash of lightning would do it. It ought to be the same way, for the agencies are the same. We have already stolen Jove's thunder for our "deep mouth'd artillery." We not after our manner when we follow up that gigantic theft by pilfering his bolts. The armament grand enough for the chief of Olympus has not yet quite come within the wielding of human hands. But it is being subdued to what it works in. It is conquered when we know how to conquer it, and Mr. JOHNSON's important communication shows conclusively that we have reached that vital stage of knowledge. Mr. JOHNSON speaks with all the more authority because of his close business relations with Mr. EDISON. It will be admitted that the American electrist has, what is claimed for him, an intelligent comprehension of the heating power of the great electrical currents required by a general system of electric lighting. He has spent great labour and toil in the effort to provide effectual means against the possibility of accident by any sudden and abnormal increase of current flow to his conductors, such as would produce an increase of their temperature beyond the point of absolute safety. Among the means and precautions employed by him may be mentioned the isolation of the street conductors in iron pipes buried in the earth, the adoption as far as possible of the same sort of conductors in the interior of houses, and where it is not practicable the adoption of a species of non-combustible insulation of a very durable character. If the electric Frankenstein turns now and then upon the magician who has raised him, it is not for want of endeavours to render him as harmless for mischief as he is, even now that he is, to use TENNYSON's figure, "but a child yet in the go-cart," so potent for good.

Mr. JOHNSON's statement is too technical for general discussion. Nor would it serve any useful purpose to discuss provisions whose real value can only be tested by actual experiment and practical application. Mr. JOHNSON assures us that simple and efficacious means are provided and are at our disposal, which may be readily comprehended and applied by any engineer, and are complete safeguards against danger to life by personal contact with the wire, and against danger to property by fire caused by the wire. The preventives are—first, an out-door system exclusively encased in iron armour; second, a house system encased in non-inflammable insulation, and further protected, as has already been said, by coverings of a substantial character. In addition to these securities we hear of "an absolute safety-valve actuated by an immutable law," which by instantaneous operation withdraws the electrical energy from a point of accident. Safety might be further ensured by the concentration in one protectible building of all sources of accidental fires created by a system of electrical lighting. In New York, where the system is an accomplished fact so far as a great area of the city is concerned, these protectives are employed, and have so far proved effective. They, or something at least equally efficacious, will have to be adopted here if electricity is to be the popular light. The use of the light is steadily progressing, and once the seemingly trifling problems still awaiting solution are solved, and it is launched upon the world as the vanquished "slave of the lamp," the application of safeguards will be of course more imperative. It may be said, indeed, that such safeguards are already employed. It is not long since we had an establishment nearly set on fire by the overheating and ignition of a wire. The tragedy at Hatfield is a later and still more notable example of the peril to be dealt with. But the peril, as Mr. JOHNSON [illegible], is not at all of the abstruse and occult character which general ignorance of the subject [illegible]. The unknown may be [illegible] well as [illegible]ficent, but it turns out that the electric current is after all not the dread and treacherous force of popular superstition, but an element thoroughly amenable to natural laws, and capable of entire control by the most ordinary means.

1976

1977

1978

1979

Electric Lighting, Strasburg Railway Stations

Centralblatt der Bauverwaltung. 1980 14. Januar 1882.

Ueber die elektrische Beleuchtung des Bahnhofs in Strafsburg i. E. nach dem System Edison geht uns folgende Mittheilung zu: Am 5. d. M. wurde die bereits früher erwähnte elektrische Beleuchtungsanlage mit Edison-Lampen auf Bahnhof Strafsburg in Betrieb genommen und hat bis jetzt einen durchschlagenden Erfolg erzielt. Die Stetigkeit und Färbung des Lichtes übertrifft selbst die kühnsten Erwartungen. Besonderes Interesse erregt die Beleuchtung des Restaurationsraumes I. und II. Klasse, zu welcher bisher zwei Siemens'sche Differentiallampen von je 150 Kerzenstärke benutzt waren, die jedoch wegen der Veränderlichkeit des Lichtes, der unangenehmen Zuckungen und der starken Schlagschatten mehrfach zu Klagen Anlafs gaben. Zur Befestigung der Edison-Lampen werden zwei von der früheren Gasbeleuchtung herrührende sechsarmige Gaskronen benutzt, an denen die Arme umgedreht sind, so dafs die Lampen mit den Tellerschirmen nach unten ragen. Die Wirkung der zwölf Lampen von je 16 Kerzenstärken in diesem 21 m langen und 8 m breiten Raume ist eine prächtige und findet die rückhaltsloseste Anerkennung; dasselbe gilt von den Lampen in den verschiedenen Büreaus, sowohl bezüglich der Lichtwirkung als der Erhaltung reiner Luft. Die gesamte Anlage ist ohne Beihülfe der Edison-Compagnie lediglich von den technischen Kräften der Kaiserlichen Generaldirection der Reichseisenbahnen unter Leitung des Telegraphen-Controleurs Schulze ausgeführt worden und soll infolge der mit dieser Beleuchtungsart erzielten günstigen Ergebnisse noch bedeutend erweitert werden. Wir behalten uns vor, nach Fertigstellung der Erweiterung, welche bereits in Angriff genommen, eine nähere Beschreibung dieser neuartigen Anlage nebst einer Kostenberechnung zu geben. Zum Schlufs sei noch erwähnt, dafs der Kaiserlichen General-Direction der Reichseisenbahnen das Verdienst zukommt, eine derartige Anlage zuerst in ganz Deutschland und darüber hinaus eingeführt zu haben.

1981

The Daily Chronicle
Jan 18 1882

1982

The Daily Chronicle Jan. 18 1882

THE ELECTRIC EXHIBITION AT THE CRYSTAL PALACE.

Another phase of this highly [illegible] and eminently practical exhibition was inaugurated [illegible] by the display in the concert room of the Edison Electric Light System [illegible] the representative of [illegible] in England, had invited a [illegible] of engineers and other gentlemen [illegible] to judge of the merits of the light, and, [illegible] that everything might be in good [illegible] order, the engine had been running at intervals since Saturday last. As occasionally happens, however, even when more than ordinarily careful preparations have been made, a slight accident occurred at the last moment which threatened to render useless the visit of those who did not arrive until the hour stated on the invitation card. The concert-room was brilliantly illuminated when, just before seven o'clock, the safety plug of the engine blew out, and for the time operations were suspended. But hopes of exhibiting the system to the later comers were not given up, and after an interval of a little over an hour the intimation was afforded that the engine was again working, and Mr. Johnson gave the signal for the gas to be reduced. At once the concert-room was lighted in the most successful manner, the illumination being exceedingly steady and perfectly under control throughout the remainder of the proceedings. Around the gallery and crossing the orchestra was suspended a string of lamps—about 140 in number; in the centre of the room was a handsome glass chandelier containing many more lamps, and at one extremity was a gilt pendant, in which lamps were placed within branches representing bell-shaped flowers in pink and blue glass. The effect of the latter ornament was very pretty, whilst the larger illumination in the centre was both elegant and simple. Another charming feature of the display was a table where a lamp rested on an [illegible] of real flowers. Altogether there were in the concert room over 200 lights, each of nominally 16-candle power, though the illumination obtained last night was estimated at between 20 and 25. The engine was [illegible] horse-power nominal, driving four of Edison's smaller machines of 60 lights, but capable on emergency of producing 75 lights. Subsequently, in his capacity of president at a collation, Mr. M'George, on the part of the Crystal Palace Company, proposed success to the Edison light, which was responded to by Mr. Johnson, who, in the course of his remarks, observed that such a temporary accident as they had had that evening was not likely to occur again, as it was intended to have three engines instead of one. Mr. M'George, when his health was proposed, stated that the directors were largely and deeply interested in the question of electric lighting, inasmuch as the Crystal Palace had always been the exponent of advanced science and art, and in this exhibition it was their endeavour to give every exhibitor the fairest opportunity of beating his neighbour if he could. From what he had seen, however, he believed the Edison system was second to none. Colonel Gouraud, as a friend of Mr. Edison, spoke in the highest terms of the abilities of Mr. Johnson in the fields of telephonic communication and electric lightning. After an acknowledgment from Mr. Johnson and a few words from Sir Charles Bright (who said Mr. Edison when he came to England might be sure of a hearty welcome) and Admiral Inglefield, the party separated, many descending to the lower floor to view the engine at work. In this international exhibition the Edison light will naturally attract great attention, and the display of last evening certainly evinced novelty and exquisite taste in its utilisation.

JOURNAL OF THE SOCIETY OF ARTS,
FRIDAY, JANUARY 13, 1882.

1983

~~JUVENILE LECTURES.~~

RECENT WONDERS OF ELECTRICITY.

By W. H. Preece, F.R.S.

Lecture II.—Delivered on Wednesday, 4th January, 1882.

Last week, when we had the pleasure of meeting, I endeavoured to disabuse your minds of any such idea as that electricity was a fluid, or, in fact, any kind of matter. I pointed out to you that every electric phenomenon really was a form of that curious, mysterious agency that exists throughout nature, that produces all the work done on the face of the earth, that probably is at the root of life itself, called energy. Nevertheless, we can speak of electricity as though it were a distinct entity; precisely in the same way that we speak of sound, of light, and of heat. We know that sound and heat are not sensible to the touch, or taste, or sight; so electricity is of the same character, and is invisible and insensible in every shape or form. Morover, we cannot either create or produce energy; there is only a certain fixed quantity of energy in the universe, and all that we can do is simply to transform it into its different shapes, such as I illustrated to you last week. All physical phenomena, without a single exception, may be traced to the mere transformation of this energy. I showed you on the last occasion how, by simply winding a wire round a mass of iron, and sending a current of electricity through the wire, we could produce that form of energy called electro-magnetism. To-night I have to speak of one or two other forms in which this energy does its work, forms in which, when electricity is transferred through matter, it does work in some shape or another. The operation of the electric current, when passed through chemical compounds in solution or liquid, is to tear asunder the constituents of the compound, and to arrange them on different sides. A simple means of illustrating this is a glass jar, like the one before you, containing water and two glass tubes, each fitted with a stop cock. When an electric current is passed through the water, the elements of water, oxygen, and hydrogen, are driven asunder, and take refuge, as it were, in the right or left-hand tube respectively. To prove that these gases have been collected, if a lighted match be placed over the hydrogen tap, the hydrogen will give evidence of its presence by inflammability; but if the match be blown out and immediately presented to the tap of the tube containing the oxygen, that gas will make its presence evident by relighting the match. [Experiment shown.] The effect of the passage of electricity through water is something like the effect which would be produced by a storm, or other agency, in this room, which caused all the boys of this audience to go to one side, and all the girls to go to the other—excepting that in water there are always two parts of hydrogen to one part or volume of oxygen. Not only does the current tear asunder the oxygen and hydrogen of water, but it also breaks up the constituents of most of the chemical compounds, and the weight of material decomposed per second is an exact measure of the work done, and of the current flowing. For instance, if we take a solution of sulphate of copper and pass electricity through it, the solution is broken up into copper and sulphuric acid, and if a bunch of keys were put into the solution while the electricity was passing through it, the keys would receive a deposit of copper. If nitrate of silver solution were used instead of the sulphate of copper solution, silver would be

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deposited upon the keys or piece of metal inserted. Through the kindness of Mr. Bolas, I am able to show you an experiment of this kind, which will enable me to give you a record of this evening's entertainment. I have here, a large glass dish containing a liquid, which, no doubt appears to you like water, but, which is really a solution of the double salt of cyanide of silver and potassium. In this solution, I now place a piece of sheet copper, which you see has the usual appearance of copper all over it. Now, while that plate of copper is inserted to one half its extent in water, we will pass electric currents through the liquid from the hand-dynamo machine on the table [experiment proceeding], which cause the cyanide of silver to break up into cyanogen on one side, and silver on the other, and if I take out the plate of copper, you see there has been deposited upon its immersed surface a coating of silver. Silver spoons and all the various kinds of electro-plate wares receive their silver deposit in the manner I have just shown you. Now, we will set this small dynamo-machine in action by turning its handle, thus converting the energy of the human body into electric energy; and we will immerse a quantity of brass buttons in the liquid, which, when they have received their coating of silver, will be laid aside, ready for distribution as a memento at the close of the lecture. Through the kindness of Messrs. Elkington, I am able to show you the handsome specimens of electro-plating which hang on the walls of the room, and which were plated at their works at Birmingham, by a process exactly similar in character to that I have described, excepting that steam-power is substituted for the manual labour you just saw for producing the electric currents.

We next come to the work performed by electricity in passing through solids. The result of that work is simply the production of heat. Before me you will notice two brass stands, and between them I will suspend a piece of fine platinum wire. I now join up one of my battery wires (the same that I used last week) to one of the brass stands, and touch the other brass stand with the other battery wire; the effect appears as a red glow in the platinum wire. If I bring one of my battery wires from the bottom of the brass stand to the end of the platinum wire, the colour of the glow becomes brighter; and as I move my battery wire along the platinum wire the glow or light produced by the high temperature in the platinum becomes more and more intense, until finally, when it reaches a certain temperature (about 3,000° Fahr.) the wire is ruptured, and falls to the ground. That is evidence that the passage of electricity, through solid conductors, produces heat, and the amount of heat produced is proportioned to the work done in the battery. Energy expended in one part of a circuit must be given out at another. If zinc is consumed in a battery, it generates a certain amount of energy, that energy must be evident in some other part of the circuit, and the heat you saw in the platinum was really the heat that would have appeared in the battery itself if we had not caused the current to flow through a solid conductor which offered a considerable amount of resistance to its progress, as compared with the resistance in the battery itself. This power of producing heat has been utilised in various ways, such as for firing fuses. [An Abel fuse was exploded.] At many places throughout the country, time guns are fired by such an electric fuse to announce the Greenwich time current at a certain hour. Mines and torpedoes are exploded in a similar manner; quarries are blasted, and many other results are brought about by passing electricity through platinum wire placed in explosive substances, or by special fuses. I do not intend to frighten or alarm you, but for your amusement, and through the kindness of Professor Abel, I have had fuses fixed out of harm's way at various points round the room, and when a small current is passed through them you will hear the explosion produced. [Experiment carried out.] Those fuses might have been fixed miles away, and the same effect would have been produced, and from it you will understand how a number of charges can be fired, or a number of guns can be discharged simultaneously on board our large men-of-war.

The next branch of the subject is the work done by electricity in its passage through air and gases. I have shown you that, in its passage through liquids, it tears the constituents of the solution asunder; in its passage through solids heat is produced; and in its passage through air, it not only produces heat, but violent projection of material particles as well, which it renders incandescent, producing sparks, heat, and other disruptive effects. To illustrate this, I have provided an Apps' induction coil, to which can be joined up vacuum tubes of various kinds, and through which the currents produced by the hand dynamo-machine will be passed. [A beautiful collection of vacuum tubes, fitted with various rarefied gases, was then shown, while the lights

Electric Exhibition at the Crystal Palace, and among the proposals to be laid before Parliament next Session is a project for constructing an electric railway between Northumberland-avenue and Waterloo Station. Again, at the Paris Exhibition, an enterprising firm of agriculturists showed land-ploughing by electricity, and in fact, the application of electricity to innumerable useful purposes was illustrated; rock boring, newspaper printing, driving of sewing-machines, embroidery, leather work, glass-cutting, wood-carving, lifts raised, ventilation assisted, &c. I am looking forward to the Crystal Palace Exhibition with great interest, to see how far these exhibits will be repeated. The Exhibition will be well worth a visit; in fact, all Exhibitions are worth visiting, for they excite interest, they induce everyone, more or less, by generating curiosity, to add to his knowledge, they honestly stimulate national as well as individual competition, and they always result in the enlargement of the useful application of a power like that of electricity, because a man of one trade who sees electricity used in another trade cannot resist thinking out whether it cannot also be usefully applied to his own purposes. We sometimes hear electricity spoken of as a mysterious agency, and sometimes as a wild, untamed beast. It is only mysterious to the ignorant, and it is only untamed to the unskilled. I hope that the promise I made to you at first starting, that you would leave this room with a fair knowledge of how the electric light is produced, has been fulfilled, and I can only add that electricity will always prove an obedient slave to those who take the trouble to understand it; but it may, and it has, proved a very dangerous ally to the ignorant and the unskilled.

A hearty vote of thanks was accorded to Mr. Preece for his two lectures.

SIXTH ORDINARY MEETING.

Wednesday, January 11th, 1882; ANDREW CASSELS, Member of the Council, in the chair.

The following Candidates were proposed for election as Members of the Society:—

Ainslie, Oliver Alexander, F.R.Hist.Soc., 48, Lincoln's-inn-fields, W.C.
Birkbeck, Edward, M.P., Horstead-hall, Norwich.
Brereton, Cuthbert Arthur, M.I.C.E., 23, Delahay-street, S.W.
Brind, Alfred Walter, M.I.C.E., East Preston, near Worthing.
Burch, Nathaniel Geach, Brunswick-house, Dartmouth-park, Forest-hill, S.E.
Carmichael, David, Ward Foundry, Dundee.
Carter, E. Harold, F.S.S., 33, Waterloo-street, Birmingham.
Cook, Arthur Stanton, 14, Furnival's-inn, E.C.
Cooke, William Henry, Lea Bank, Coppice, Oldham.
Common, Andrew Ainslie, F.R.A.S., 63, Eaton-rise, Ealing, W.
Cropper, Samuel, 28, Budge-row, Cannon-street, E.C.
Crossley, Richard, Bentcliffe-house, Accrington.
Cust, Robert Needham, F.R.G.S., 64, St. George's-square, S.W.
Dadson, Albert William, 6, Raymond-buildings, Gray's-inn, W.C.
Dowson, Joseph Emerson, A.M.I.C.E., M.I.M.E., 3, Great Queen-street, Westminster, S.W.
Fell, John, Augusta-place, Leamington.
Fyfe, John, 9, Grosvenor-terrace, Glasgow, and Young's Paraffin Light and Mineral Oil Company, 7, West George-street, Glasgow.
Henderson, Ridley, 9, Bush-lane, Cannon-street, E.C.
Holthouse, Carsten, 15, Percy-st., Bedford-sq., W.C.
Jones, Thomas John, 12, Princes-street, Hanover-square, W.
Kingzett, Charles T., F.C.S., F.I.C., 17, Lansdowne-road, Tottenham.
Ladd, John Haskins, 116, Queen Victoria-street, E.C.
Leonard, Hugh, 7, Hanover-square, W.
Lloyd, Robert Samuel, 84, Upper Whitecross-st., E.C.
Macdonald, Colonel R. M., 80, Oxford-gardens, North Kensington, W.
Moll, Frederick Henry Ludwig Raphael, 18, Old Broad-street, E.C.
Radford, Frances, 26, Pembridge-gardens, W.
Russell, Joseph, Glenclune, Port Glasgow.
Schram, Otto, 49, Wood-street, Woolwich, S.E.
Scott, Edward Lionel, Salters'-hall, St. Swithin's-lane, E.C.
Simpson, James Carrington, M.I.C.E., Broadway-chambers, Westminster, S.W.
Speck, Thomas Samuel, M.I.C.E., 8, Eaton-rise, Ealing, W.
Wallis, George Ambrose, M.I.C.E., 14, Sea-side-road, Eastbourne.
Watson, John William Mitton, M.I.C.E., Clevemont, Silverhill, St. Leonards-on-Sea.
Williamson, George Charles, The Institute, Guildford.

The following Candidates were balloted for and duly elected Members of the Society:—

Allfrey, Edward Richard, South Eden-park, Beckenham, Kent.
Austin, Josiah, Nechells-house, Nechells, Birmingham.
Ayrton, William, Wigan-road, Ormskirk.
Clerk, John Somervail, 39, Prince's-square, W.
Colvin, Clement S., India-office, S.W.
Glover, Walter T., Moorhurst, Kersal, Manchester.
Hallett, Holt Samuel, M.I.C.E., F.R.G.S., 37, Edgware-road, W.
Hawksley, Thomas, 97, Adelaide-road, N.W.
Hill, James Woodward, A.M.I.C.E. (Mayor of Bedford), Kimbolton-road, Bedford.

1985

THE ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.

THE forthcoming show of electrical apparatus at Sydenham is by no means in an advanced state as yet, and any one going there after reading the reports of the newspapers will almost certainly be disappointed. In fact, the visitor has still some difficulty in discovering where the so-called "International" Exhibition is, and any electrical apparatus that is exposed belongs exclusively to this country, if we except the electric lamps of M. Gravier, and the telephones of Dolbear. The Exhibition, though by no means complete, will, we are certain, never bear comparison for a moment with the recent one at Paris. There are many reasons for this, which we need not now enumerate, but perhaps the chief of these are the ill-chosen time, following hard on the closure of the Paris one, and the unfortunate place selected. Beautiful as it is in many respects, the Crystal Palace is pre-eminently a place of entertainment, and scientific apparatus are in a false position, beside Christmas pantomines and glass cases of perfumery. The Palace authorities have invited manufacturers, scientific bodies, electrical inventors, and even Government departments, to display their instruments of precision; but they have only been able to allow them spaces here and there amidst the existing stalls of dry goods and the numerous refreshment bars, statues, and ornamental courts. The result is that the articles exhibited will be scattered here and there, presenting no unity of grouping, and likely to be overlooked. We are sorry for the sake of electrical science that such is the case, and we cannot wonder that some exhibitors have refused to exhibit under such conditions; but the redeeming point is that there is a fair promise of an excellent display of the electric light. For this the magnificent nave of the Palace, with its varied objects of beauty, foliage, works of art, and coloured wares, will offer a splendid vista when illuminated by the radiance of many arc and incandescent lamps. Never before perhaps will the electric light have shone upon so picturesque a scene.

The nave is allotted in sections to the various exhibitors of arc lamps; the Brush Company, which also will illuminate the Alhambra Courts with crystal chandeliers and Lane-Fox incandescent lights; the British Electric Light Company; the Electric Light and Power Company; Messrs. Strode and Co.; Mr. R. E. Crompton; M. Gravier, and Mr. Hammond will all exhibit lamps in the nave, and the Jablochkoff lamp will also be represented. Mr. Edison has a large space set apart, and his apparatus is in a very forward state, but it will be several days before he can light up. Mr. Maxim has also taken space, but his arrangements are not very advanced yet.

Edison will light the Entertainment Court, the Concert Room, and the avenue to the London, Chatham, and Dover Railway Station. The Concert Room will have a splendid chandelier of eighty 16-candle lamps, and festoons of 16-candle light will be swung round the hall from pillar to pillar, while many stars of four 8-candle lamps will be suspended from beneath the galleries. In all there will be 235 lamps in the Concert Room, and about as many in the Entertainment Court, while the avenue will require at least 500 more. The power will be supplied by three Robey engines of 25 horse power nominal, each driving four 60-lamp of 16-candle power Edison dynamos. Four of these machines are now in their places. The great machine exhibited at Paris has been installed at 57, Holborn Viaduct, and is now working there.

With regard to the other stalls, those of the Post-Office and the South-Eastern Railway Company are in an advanced state. The Post-Office exhibit is similar to that at Paris, with the addi-

1991

THE STANDARD, WEDNESDAY, JANUARY 18, 1882.

1992

THE EDISON LIGHT AT THE CRYSTAL PALACE.

The entertainment given by the Edison Company last evening at the Crystal Palace was the first opportunity afforded in England of seeing the Edison Electric Light on any adequate scale. The chief labours of Mr. Edison in electrical lighting have been devoted to the production of a system of electrical lighting for general and for domestic purposes. To this end, from the outset he selected the incandescent light, and in all his efforts he has kept rigidly to this system, and has striven to generate the particular class of current required for its service in the most economic way. The generator he has devised consists of a very large horseshoe magnet, containing a vast mass of metal excited by a small amount of current. To put it tersely, he has invested largely in iron, with the result that he gets a proportionate dividend of saleable electric current, and a small amount of electrical energy expended on its production. Or, to speak scientifically, he has a large magnetic field productive of available results. The exhibit he is preparing at the Crystal Palace represents a central station of Edison small dynamo machines. The motive power consists of three 25-horse power Robey engines, each working four Edison machines of 60 lights, of 16-candle power each, but capable of working up to 75 lights on emergencies. The machines are worked in pairs, and by means of cones actuated by capstans every pair of machines can be thrown out of and into gear as required, so that in the event of anything going wrong with the engines or the machines the system of lights can be kept in action by two engines and eight machines, whilst the defective portion or portions undergo repair. The concert hall was charmingly lighted, and early visitors had an opportunity of seeing it to full advantage, the light being driven up to certainly 25-candle power. But before the guests sat down to the splendid repast prepared for them, the beautiful light had disappeared, and the feast had to be undertaken under the dim gas burners of the now familiar dulness. The present public exhibition was dependent on one section of the electrical station, one engine and four machines only being in readiness. The engine and the 235 lights which it sustained had been running successfully since Saturday, but a quarter of an hour before the appointed time of the entertainment (seven o'clock) the fusible plug of the steam boiler gave way, and there was no power to drive the machines. The accident would have been of no noticeable consequence had the station been completed; and as it was, the commendable promptitude of the engineer in charge was such, that the fire was drawn, a new plug inserted, steam got up afresh, and the 235 lights were again burning splendidly before the feast was over. The speeches were thus delivered under a success which drew forth deservedly very great applause. The lights were turned, and every section turned off and relighted, and the complete handiness and entire control demonstrated conclusively to everybody present. The concert hall had been screened in, the tables elegantly arranged by the staff of the Palace in the short space of a single day. The lighting was charmingly efficient. In the centre of the lofty hall was a glass chandelier of cut pendants, with over 60 incandescent lights within it. It was one of the prettiest things conceivable as the play of colours in the prisms, commingling with the stars of very bright light, produced effects that were very beautiful. The galleries were lighted by twelve festoons of twelve lights each, or one hundred and forty-four in all. Besides the grand chandelier there was a smaller one, with fewer lights; and amongst the flowers in the gilt vase on the central table was a single light, illuminating their colours as only the electric light can show them off to so much advantage. —The Chairman of the Crystal Palace Company (Mr. M'George) proposed the health of the electrical engineer entrusted by Mr. Edison with the inauguration of his system in England, and Colonel Gouraud, who complimented Mr. Johnson most highly on his ability, both by energy and talent, for the arduous undertaking. —Mr. Johnson, who is a very young man, spoke in high appreciation of the friendship of Mr. Edison, and proposed "Success to the other Exhibitors of Electrical Lighting at the Crystal Palace Exhibition." — Sir Charles Bright, being called upon to return thanks, proposed the "Health of Mr. Edison," and said he was not interested as an investor in any Light Company, but he was well assured that when Mr. Edison should visit this country he would be received with such honours as had never been realised since the grand appreciation shown to Morse.—Admiral Inglefield, the Chairman of the Electrical Light and Power Generator Company, also addressed the meeting.—The departure of the visitors then took place, with a universal expression of rejoicing that that which had seemed for a time almost a disaster had been so fully retrieved.—Amongst the guests was Mr. Otto Moses, who had charge of Edison's exhibit at Paris, and whose courtesy and amiability there were appreciated by all who met him.

THE DAILY NEWS, WEDNESDAY,

Jan. 11th 1882

1995

THE EDISON LIGHT AT THE CRYSTAL PALACE.

Last evening a number of gentlemen attended at the Crystal Palace, on the invitation of Mr. E. H. Johnson, manager of the Edison electric light system, to witness the experimental lighting of the concert room in anticipation of the forthcoming exhibition. The lamps were hung in festoons between the pillars in the galleries. In the centre of the room a magnificent glass chandelier was hung. The applicability of the light to ornamental lamps was also shown in a tinted glass chandelier in which the brilliant incandescence seemed to spring from the convolvulus. In the centre of the room on one of the tables, at which the guests were dining, an epergne of natural flowers was made charmingly conspicuous by the illumination of one of the lamps set in the midst of the beautiful exotics. There were in all some 215 lights, each of them of sixteen candle-power. The light was remarkably steady and soft, and its illumination of a room tastefully decorated with English and American flags evoked hearty expressions of admiration. The inevitable *contretemps* at first exhibitions happened on this occasion, rather fortunately for the credit of this system. The power was at first run rather too high, and one or two of the lamps gave way, but only to show the spectators that such an accident could happen without the least danger, and without in any way affecting the other lamps in the circuit. At the command of Mr. Johnson the lights were put out alternately on each side of the building, and in the chandeliers, without affecting the brilliancy of the others, thus proving the success of the distribution of the light. In this system of lighting the danger of fire is guarded against by the introduction into the circuit of a kind of safety-plug, through which the current is carried over a small portion of lead wire. In case of an accidental overcharge of electricity this metal would fuse before the rest of the conductor could be sufficiently heated to set fire to anything, and the current in that particular branch of the lighting system would be interrupted till the danger was obviated. Then, by the simple screwing in of another plug, the current would be restored to the particular part of the wire where the accident occurred. Mr. M'George, on behalf of the company present, congratulated Mr. Johnson, and through him his principal, Mr. Edison, on the success of the experiment. Mr. Johnson expressed his thanks, and before the conclusion of the proceedings proposed the health of the other exhibitors of electric lighting at the Crystal Palace.

1996

1997

2000

ELECTRIC LIGHTING.

Mr. Edison's section of the Electrical Exhibition at the Crystal Palace was inaugurated last night, the installation being opened by the illumination of the Concert-room. From the roof of this spacious apartment was suspended a magnificent lustre decked with incandescent lights, much as a Christmas tree is hung with toys; while round the galleries extended a chain of lamps, with here and there an ornamental candelabrum hanging with globes of peculiar brilliancy and power. In all there were some 230 filaments of carbon, raised to a white heat, and their combined effect was as fine a light as could well be conceived. The demonstration began with a mishap. Scarcely had the engine been working quarter of an hour when a fusible plug in the boiler gave way; the machinery had to be stopped and the gas relit. The interruption was not of long continuance, and when the current again flashed along the wires there was a prolonged cheer of congratulation. Mr. Edison's apparatus necessarily differs in no essential respect from that of other exhibitors; and yet, with the exception of the motive power, every part of it is original. His carbons are made from bamboo, the filaments, which are only the thickness of a hair, being enclosed in air-tight pear-shaped glasses. Like the lamps of Swan, and some other inventors, they are exhausted of the atmosphere, and this quality gives a certain security against fire. The admission of air by the accidental breakage of the glass consumes the carbon almost instantaneously, so rapidly indeed that probably no substance but an inflammable gas would be ignited by the contact. During the experiment two of the globes broke, with no perceptible effect on the rest. If they had been surrounded by the most combustible drapery, no danger would have ensued. The extent to which subdivision and control of the electric current have been carried was exhibited by turning off and on at will separate sections of the chain of lights without affecting the remainder. Mr. Edison has given a completeness to his system by inventing regulators determining the supply, metres to measure the quantity used, and his own dynamo-machines for converting the motive power into electricity. Considering that this motive force was an ordinary steam-engine of 25-horse power, the amount, steadiness, and brilliancy of the light were remarkable. Every horse-power of steam used yielded energy sufficient to maintain from eight to ten lamps, each equivalent to from sixteen to twenty-five candles; but the comparison would be flattering to the candles, for scarcely any conceivable array of dips could have equalled in intrinsic brightness these 230 lamps; nor could any light be more equable. Those who have formed an unfavourable opinion of electric illumination from the arc lamps of the streets or from some unfortunate trials of incandescent carbons may be assured that any apparent failures of equability and steadiness are faults of machinery only. The arc light that will not occasionally flicker has probably yet to be invented—though decided progress has been made recently in these otherwise most economical illuminators—but with any incandescent system, Maxim, Lane-Fox, Swan, or Edison, absolute steadiness has been attained. Mr. Edward Johnson, the manager of the Edison Electric Light system in this country, was heartily congratulated last night by a large gathering of electrical engineers and others interested in the exhibition on the success of the demonstration. We must wait, however, till the several installations at the Crystal Palace are more complete before any comparative judgment can be made of the various systems for the display of which the glass edifice at Sydenham is so admirably adapted. There will be much that is interesting in addition to the electric light; but in this department, which is the specialty of the present day, there can be little doubt the exhibition will be one of the most comprehensive and the most useful ever seen.

The Daily Telegraph Jan. 18th 1882

2001

THE CITIZEN. SATURDAY, JANUARY 21, 1882.

2008

THE EDISON ELECTRIC LIGHT SYSTEM.

On Tuesday evening last a select company assembled at the Crystal Palace, by the invitation of Mr. Edward H. Johnson, the manager of the Edison Electric Light System, to witness the experimental lighting, by electricity, of the concert-room. The electric lighting—which is incandescent—comprised about 144 burners in small glass globes evenly distributed along the four sides of the room and suspended a few feet from the ceiling. A handsome and massive chandelier hung in the centre, and not the least pleasing feature was a vase of flowers (placed upon one of the tables) in the midst of which burned a brilliant light. The lights were remarkably steady and soft; but it was noticeable that, in the course of the evening, eight of the small globes burst, the lights in each instance becoming instantaneously extinguished. Experiments were also shown under the direction of Mr. Johnson, whereby at a moment's notice a large or small section of the burners could be extinguished and re-ignited without affecting the remaining lights. Not less than a hundred guests sat down to the substantial collation which had been provided, but it was not until the repast had been concluded that the electric lights were turned on. Mr. Deputy McGeorge, proposed "Success to the Edison Electric Light." Mr. Edward H. Johnson, who responded on behalf of Mr. Edison, thanked the company for their presence. Referring to a slight mishap which occurred early in the evening, when the lights were suddenly extinguished, owing, as was stated, to the accidental blowing out of a plug, Mr. Johnson said that the occurrence needed no apology, as the majority of the gentlemen present being engineers would readily understand the cause of the accident. Precautions would, however, be taken at the exhibition to provide against any such failure. He had subdivided his steam power into three engines instead of one, so that in the event of the failure of an engine the remaining power would still be amply sufficient for lighting purposes. He was, however, showing the light that evening with a single engine, and although just at the last moment the safety plug had blown out, and necessitated the withdrawal of the steam, yet the delay which was thereby occasioned was of very short duration. Mr. Johnson concluded by proposing the health of Mr. McGeorge.

Mr. Deputy McGeorge acknowledged the compliment paid to the directors of the Crystal Palace Company, who, he stated, were largely interested in the success of the experiments. The company interested themselves in everything which was calculated to promote the social well-being and convenience and happiness of the people, and in his opinion electric lighting was destined to be a great and commercial success. (Hear, hear.) He then submitted the health of Col. Gouband.

Colonel Gouraud, in reply, stated that he had assisted in financing the undertaking, and invited the company to drink the joint healths of Mr. Edison and Mr. Johnson.

Mr. Johnson briefly replied, attributing his position to his association with Mr. Edison and others. Colonel Gouband and others, who had been associated with Mr. Edison as capitalists in floating his various enterprises, had likewise done much to assist him. He wished to propose the health and prosperity of his co-exhibitors at the Crystal Palace, especially in regard to the electric lighting in London. He called upon Sir Charles Bright, as a representative of these exhibitors, to respond. (Applause.)

Sir Charles Bright was afraid that his friend Mr. Johnson laboured under some delusion. He was not an exhibitor, and did not represent any electric lighting exhibition at all. He had, however, been consulted as an engineer at various times in connection with electric lighting. With reference to that gathering, he was sure that when Mr. Edison came to England he would be received with the greatest cordiality. (Applause.)

2009

L'ASSEMBLÉE GÉNÉRALE

February 8th 1882

SOCIÉTÉ 2016

Industrielle et Commerciale Edison

Société anonyme

Au capital de 1.500.000 francs

Siège social : 27, rue de la Chaussée-d'Antin

Première assemblée générale constitutive du 3 février 1882

Présidence de M. Ch. Porges.

La séance est ouverte à six heures.

M. le Président. — La feuille de présence constate que 1.635 actions, plus de la moitié du capital social, sont représentées à la réunion. L'avis de convocation a paru dans le *Droit* le 20 janvier dernier. L'assemblée générale est donc régulièrement constituée et peut valablement délibérer.

(La composition du bureau est la même que pour les deux assemblées précédentes.)

M. le Président donne lecture de l'avis de convocation.

M. Baudrier donne lecture de deux actes passés devant Mes Baudrier et Mégret, le 2 février courant, constatant : le premier le dépôt par M. Porges et les mandataires de M. Edison des statuts d'une Société anonyme formée pour cinquante ans, au capital de 1.500.000 fr., divisé en 3.000 actions de 500 fr chacune et dont le siège social est à Paris, 27, rue de la Chaussée-d'Antin ; le deuxième la déclaration faite par les mêmes comparants que la totalité des actions a été souscrite et que le montant intégral de chaque action a été intégralement versé en numéraire à la Banque centrale du commerce et de l'industrie.

A la suite de cette lecture, l'assemblée adopte à l'unanimité la résolution suivante :

« L'assemblée générale, après avoir pris connaissance des statuts et de la déclaration contenue dans les actes précités reconnaît, après vérification, l'exactitude et la sincérité de cette déclaration. »

Il est ensuite procédé à la nomination des commissaires chargés de présenter le rapport sur la valeur des apports et des avantages stipulés en faveur des fondateurs.

MM. Samuel et Jutet son nommés à l'unanimité commissaires.

Ces messieurs acceptent les fonctions.

La séance est levée à six heures un quart.

2019

Société électrique Edison

Société anonyme au capital de 1.000.000 de francs

Siège social ; 27, rue de la Chaussée-d'Antin.

Première assemblée générale constitutive du 3 février 1882.

Présidence de M. Ch. Porges

La séance est ouverte à 5 h. 1/2.

M. le Président. — La feuille de présence constate que 1.027 actions, c'est-à-dire plus de la moitié du capital social, sont représentées à la réunion. L'avis de convocation a été inséré le 20 janvier dernier dans le journal *le Droit*. Toutes les formalités légales ont donc été remplies ; l'assemblée générale est en nombre et peut valablement délibérer.

Il est procédé à la constitution du bureau qui se compose des mêmes membres que celui de la Compagnie continentale Edison

M. le Président donne lecture de l'avis de convocation.

Me Baudrier donne lecture de deux actes passés devant Mes Baudrier et Mégret, le 2 février présent mois, constatant : le premier, le dépôt par M. **Porges** et les mandataires de M. Edison des statuts d'une Société anonyme d'une durée de 50 ans, au capital de 1 million, divisé en 2.000 actions de 500 fr. chacune, dont le siège social est provisoirement fixé à Paris, rue de la Chaussée-d'Antin, n° 27 ; le deuxième la déclaration faite par les mêmes comparants que les 2.000 actions ont été entièrement souscrites et que le montant de chacune d'elles a été intégralement versé, le 15 janvier dernier, à la Banque centrale du Commerce et de l'Industrie.

A la suite de cette lecture, l'assemblée adopte à l'unanimité la résolution suivante :

« L'assemblée générale, après avoir pris connaissance des statuts et de la déclaration contenue dans les actes précités, reconnaît, après vérification, l'exactitude et la sincérité de cette déclaration. »

M. le Président explique que le but de la Société est, comme pour la Société continentale, la mise en valeur des brevets cédés par M. Edison pour la production de la lumière et la transmission de force motrice par l'électricité, mais que le but spécial de la Société électrique est l'application de ces procédés à des établissements particuliers et isolés.

Il est ensuite procédé à la nomination des commissaires chargés de vérifier la valeur des apports et l'importance des avantages accordés aux fondateurs, avec mission de présenter un rapport sur ce point à la deuxième assemblée générale constitutive.

MM. Edmond Reville et Jutet sont élus commissaires à l'unanimité et acceptent ces fonctions.

La séance est levée à 6 heures.

Compagnie Continentale Edison

Société anonyme au capital de 1.000.000 de fr.

2022

27, rue de la Chaussée-d'Antin

Première assemblée générale constitutive du 3 février 1882

Présidence de M. Ch. Porges

La séance est ouverte à 5 heures.

M. le Président. — La feuille de présence constate que plus de la moitié du capital social se trouve représentée à la réunion. L'avis de convocation, d'autre part, a été inséré, conformément à la loi et aux statuts, dans le journal le *Droit*, numéro du 29 janvier 1882. Toutes les formalités légales ont donc été remplies, l'assemblée générale est donc régulièrement constituée et peut valablement délibérer.

Il est procédé à la formation du bureau.

M. Porges, en qualité de fondateur de la Société, est élu, à l'unanimité, président.

M. le Président. — J'invite, pour compléter le bureau, les deux plus forts actionnaires présents: MM. Chatard et le représentant de la maison Drexel-Haiges et Cᵉ, à venir m'assister comme scrutateurs

(MM. Chatard et le représentant de la maison Drexel-Haiges prennent place aux côtés de M. le Président. Le bureau, ainsi constitué, désigne M. Georges Labey pour remplir les fonctions de secrétaire.)

M. le Président donne lecture de l'avis de convocation.

Mᵉ Baudrier, notaire, donne ensuite lecture de deux actes passés, le 2 février courant, devant Mᵉˢ Baudrier et Mégret, notaires à Paris, constatant: 1° le dépôt par M. Porges et les mandataires de M. Edison des statuts d'une société anonyme au capital de un million, divisé en 400 actions de 2.500 francs chacune, dont la durée est de cinquante ans et le siège provisoire à Paris, rue de la Chaussée-d'Antin, nº 27; 2° la déclaration faite par les mêmes comparants que la totalité des actions a été souscrite et que le montant de chacune d'elles a été intégralement versé à la Banque Centrale du commerce et de l'industrie le 15 janvier 1882.

A la suite de cette lecture, l'assemblée a adopté à l'unanimité la résolution suivante:

« L'assemblée générale, après avoir pris connaissance des statuts et de la déclaration faite par les fondateurs et énoncée dans les actes précités, reconnaît l'exactitude et la sincérité de cette déclaration, qu'elle a vérifiée. »

Il est ensuite procédé à la nomination de deux commissaires chargés de vérifier la valeur des apports et d'apprécier les avantages stipulés au profit des fondateurs.

MM. Edmond Réville et Jutet sont élus commissaires à l'unanimité et acceptent ces fonctions.

M. Jutet. — Je demande à présenter une observation. Est-ce que la loi n'exige pas que les commissaires fassent partie de la Société comme actionnaires?

Mᵉ Baudrier répond que la loi est muette à cet égard et qu'il n'est pas douteux, suivant lui, qu'on puisse nommer les commissaires en dehors des actionnaires. Il peut se faire, en effet, qu'il ne se trouve pas parmi ces derniers un seul membre possédant des connaissances spéciales suffisantes pour apprécier la valeur des apports et des avantages attribués aux fondateurs.

M. de Parville. — J'ai été nommé deux fois pour exercer ces fonctions pour des Sociétés dont je ne faisais pas partie comme actionnaire.

L'incident est clos et la séance est levée à 5 h. 1/2.

Société générale des Téléphones

Acte reçu de Jean Dufour, notaire à Paris, le 16 novembre 18 1. Il a été formé une Société anonyme. Dénomination: *Société générale des Téléphones.*

Objet:

La création et l'exploitation de réseaux téléphoniques;

L'exploitation des brevets apportés à la Société et de tous autres dont elle pourra devenir propriétaire par la suite, par acquisition, apport, ou de toute autre manière;

La fabrication et la vente des instruments, appareils, câbles et matériel, ayant pour but une application quelconque de l'électricité;

L'acquisition, la création ou la location de toutes usines et immeubles nécessaires au fonctionnement de ses services.

Durée 99 ans; siège social, à Paris, rue des Petits-Champs, 66. Fonds social, 25.000.000 de francs en 50.000 actions, sur lesquelles il en est attribué 17.3·0 entièrement libérées à M. Jametel en représentation de ses apports; 15.400 sont souscrites dans les proportions suivantes; 5.200 par la Banque d'Escompte de Paris; 5.200 par la Banque Franco-Egyptienne et 5.000 par la Compagnie internationale des Téléphones.

Administrateurs:

MM. Armengaud jeune, ingénieur;

Bivord (Charles), directeur du *Bulletin des Halles*;

Duchateau (Edmond), secrétaire du Crédit mobilier;

Jametel (Amédée), banquier;

Lair (Jules), directeur de la Compagnie des Entrepôts et Magasins généraux de Paris;

Lecey (Georges);

Naudet (Alfred), ingénieur;

De Parville (Henri), ingénieur.

Commissaires, MM. Della Faille de Liverghem; L. Soutorin et A. Vuignier. Dépôt au deuxième du 16 janvier 1882.

2023

Société générale pour l'utilisation des forces électriques.

Acte reçu Dufour, notaire à Paris, le 15 décembre 1881. Il a été formé une Société anonyme. Objet :

La production de l'électricité;

Son application en France et à l'étranger, à toutes les branches de l'industrie et du commerce, à l'agriculture, aux sciences et aux arts, d'après tous les procédés brevetés ou non brevetés, connus actuellement ou qui seront découverts ultérieurement;

Toutes entreprises concernant l'utilisation de l'électricité comme éclairage, agent de transmission télégraphique et téléphonique et comme force motrice;

La construction de tous câbles, machines et appareils pouvant servir à la production, à l'application et à la consommation de l'électricité;

L'acquisition de la propriété, l'usage ou la location de tous procédés, brevets et inventions généralement quelconques se rattachant à l'électricité et à ses diverses applications;

La cession totale ou partielle, en toute propriété ou à titre d'usage ou de location, des brevets, procédés ou inventions appartenant à la Société à un titre quelconque;

Et en général toutes les opérations, entreprises et exploitations industrielles et commerciales concernant l'utilisation, la transformation, l'application et la consommation de l'électricité comme élément de force, de lumière et de chaleur.

Dénomination : *Société générale pour l'utilisation des forces électriques.*

Siège à Paris, rue d'Antin, 9.

Durée, 50 ans.

Capital social, 75 millions de francs en 150.000 actions sur lesquelles il sera versé 250 fr. en souscrivant.

Il est, en outre, créé 3.000 parts de fondateurs sur lesquelles 1.000 sont attribuées à l'Union générale à raison de son concours à la constitution de cette Société.

Administrateurs : MM. Eugène Bontoux, président de l'Union générale, demeurant à Paris place Vendôme, 12;

Le baron Blancard (Louis Guy), à Paris, rue de l'Université, 80;

Léon Chabert, à Paris, rue de Lisbonne, 2;

Dupuy de Lôme (Stanislas-Charles-Henri-Laurent), sénateur, membre de l'Institut, à Paris, rue Saint-Honoré, 374;

Jules Féder, directeur de l'Union générale, à Paris, rue Montchanin, 3;

Ferber (Auguste-Ernest-Charles-François), à Lyon, quai de l'Est, 1;

Baron Edouard Girod de l'Ain, à Paris, boulevard Haussmann, 121;

Vicomte Emmanuel d'Harcourt, administrateur de l'Union générale, à Paris, rue de Grenelle, 142;

Léon Riant, vice-président de l'Union générale, à Paris, rue de Berlin, 38;

Baron Charles de Wimpffen, à Paris, rue Clapeyron, 23.

Dépôt au deuxième du 16 janvier 1882.

2024

Scrapbook

RAPPORT

DES COMMISSAIRES NOMMÉS POUR LA VÉRIFICATION DES APPORTS NE CONSISTANT PAS EN NUMÉRAIRE, DANS :

1° **La Compagnie Continentale Edison**, Société anonyme au Capital de Un Million de Francs;

2° **La Société Industrielle et Commerciale Edison**, Société anonyme au Capital de Quinze cent mille Francs;

3° **La Société Électrique Édison**, Société anonyme au Capital de Un Million de Francs.

Messieurs les Actionnaires,

En vertu de l'article 4 de la loi du 24 juillet 1867, vos Assemblées respectives du 3 février courant nous ont fait l'honneur de nous confier la vérification des apports servant de base aux **droits et avantages attribués à la Light Company** et à **M. Edison** par les articles 43 des **deux premières Sociétés et l'article 42 de la troisième.**

Malgré leur autonomie, les trois Sociétés se rattachent, en fait, à la mise en valeur d'une même invention ; elles dérivent du même contrat primitif; elles sont appelées à suivre la même fortune; elles ont la même durée et un certain nombre d'Administrateurs communs. Vos Commissaires ont donc pensé qu'en vous adressant un rapport d'ensemble sur les trois Sociétés, ils simplifieraient leur mission en même temps qu'ils rendraient leur travail d'examen plus clair et plus complet pour tous les intéressés.

Par conventions du 15 novembre 1881, **M. Edison** et la **Light Company** agissant conjointement et solidairement, ont promis de céder à l'une de vos trois Sociétés la

Société générale pour l'utilisation des forces électriques.

Acte reçu Dufour, notaire à Paris, le 15 décembre 1881. Il a été formé une Société anonyme. Objet :

2023

propriété, sans autre garantie que celle de leur existence, de tous brevets et inventions **Edison** ayant pour objet de mesurer, distribuer et appliquer les courants électriques pour la production de la lumière électrique et la transmission de la force motrice. Cet engagement, en ce qui concerne les inventions futures, est pris pour cinq années par la **Light Company** et **M. Edison** conjointement, et pour douze autres années par **M. Edison** seul.

C'est conformément à ces mêmes conventions que vos fondateurs ont défini l'objet et réparti les attributions de chaque Société dans la mise en valeur des inventions **Edison**. Ainsi, ils ont créé :

La Compagnie Continentale, pour la prise des brevets, leur vente et la cession des licences ;

La Société Industrielle et Commerciale, pour la fabrication et la vente des appareils ;

La Société Électrique, pour les installations isolées.

Les apports de **M. Edison** et de la **Light Company** comportent des engagements de deux sortes : 1° Livraison effective et immédiate, à la Compagnie Continentale, de tous les brevets existants pour les pays désignés au contrat ; 2° Promesse relative aux inventions futures de **M. Edison** ayant le même objet.

Nous avons dû, bien entendu, nous borner au dénombrement des brevets actuels. L'état des brevets **Edison** qui nous a été soumis par l'un des notaires qui ont reçu vos actes de Société comporte :

26 brevets français délivrés ;
7 brevets français demandés mais non encore délivrés ;
21 20 brevets austro-hongrois ; 26 5 more accord.
8 brevets austro-hongrois non encore délivrés ; 3
28 brevets belges ;
27 brevets italiens ;
20 brevets espagnols ; two more accorded
9 brevets espagnols non encore accordés ; 22 + 7
3 brevets allemands ;
5 brevets danois.

La cession de tous ces brevets ne peut être régularisée qu'après votre constitution définitive.

Nous venons de vérifier, quant à leur existence et quant à leur cause, les apports de **M. Edison** et de la **Light Company**. La loi veut que nous vous parlions de leur valeur. Sur ce dernier point, nous vous ferons simplement remarquer que le prix des apports consiste exclusivement dans une participation des apporteurs aux bénéfices, et que ces bénéfices sont même primés par le remboursement complet du capital dans les deux Sociétés, **Continentale** et **Electrique**. Au surplus, Messieurs, vous avez pour garantie de l'avenir des résultats acquis et la notoriété déjà immense d'un inventeur dont l'œuvre n'a pas de limites.

Sous le mérite de ces considérations, vos Commissaires concluent à l'approbation, par chacune de vos Assemblées en ce qui la concerne, des apports et avantages de **M. Edison** et de la **Light Company**, tels que les dits apports et avantages se poursuivent et comportent dans vos statuts respectifs et dans la convention qui les a précédés.

Paris, le 6 février 1882.

Les Commissaires de la Société Industrielle et Commerciale Edison,

L. SAMUEL. J. JUTET.

Les Commissaires de la Compagnie Continentale Edison,

Ed. RÉVILLE J. JUTET

Les Commissaires de la Société Électrique Edison,

Ed. RÉVILLE J. JUTET

Paris-Imp. LEFEBVRE, Pass. du Caire 87-89.

2027

La luce elettrica Edison alla Scala.

L'infaticabile signor James Shepherd, rappresentante in Italia della Società Edison, per far apprezzare degnamente il sistema, ha con questo illuminato il salone del ridotto della Scala, e venerdì sera, la prima dell'esperimento, che durerà quindici sere, la Commissione municipale incaricata di studiare l'applicazione della luce elettrica ai teatri, ha potuto vedere e giudicare queste piccole lampade del celebre inventore americano.

Il successo non poteva essere più bello e completo, tanto più che risaltava il confronto colla luce dei lampadari a gas delle sale attigue.

Come si sa, il salone del ridotto ha tre lampadari con 92 becchi a gas, complessivamente. Ebbene, è precisamente su questi 92 becchi che il Shepherd ha infisso 92 lampade Edison, della forza di 8 candele cadauna, ossia di una fiamma comune a gas.

La lampada Edison dà una luce calda, vivida, fissa, che non altera i colori del viso, nè delle vesti: il bleu, il rosa, per esempio, restano bleu e rosa, e non paiono, come col gas, verde e vermiglio.

Le lampade Edison sono di tre categorie, della forza cioè di 16, di 8 e di 4 candele, si prestano per tutti gli usi, anche per i più modesti di servizio domestico, se ne può regolare, moderare, attenuare, come si voglia, la forza, e sono indipendenti l'una dalle altre. Quelle applicate ai lampadari del ridotto sono, come abbiamo detto, della forza di 8 candele.

Un altro vantaggio del sistema sta nella facilità della sua adozione, in quanto che alle lampade Edison possono servire di sostegno gli stessi apparecchi del gas.

La prova dell'altra sera persuade della opportunità di illuminare non solo una sala, ma tutto un teatro, compreso il palco scenico, poichè, data la facilità di moderare a piacimento la luce e di darle anche le tinte che meglio convengono, parrebbe risoluto il problema delle esigenze degli spettacoli, è tolto il calore (e il toglierlo dai lumi della ribalta sarebbe un naturale vantaggio per gli attori e i cantanti), e tolta la causa principale di incendio.

In questo esperimento l'egregio J. Shepherd fu assistito dal sig. Acheson, perito elettricista, allievo di Edison.

I fili sono ricoperti di una materia incombustibile, che ora si possono vedere, perchè trattasi di un esperimento, e che diversamente sarebbero mascherati.

Nel sistema Edison si completano a vicenda la lampada, la macchina dinamo-elettrica e la canalizzazione co'suoi commutatori, regolatori, contatori.

La lampada — frutto di pertinaci studi e di molteplici prove — è un globo chiuso, di vetro, grande come una grossa pera, contenente un filo di carbone in fibra di un *U* rovesciato, ottenuto da una firma di carbone e della grossezza di un crine. Agli estremi è collegato a due fili di platino, che vi conducono la corrente.

Il globo, vuoto d'aria, è chiuso da un disco di materia isolante, attorno a cui sono saldati due anelli in rame, per mezzo dei quali la corrente passa dai fili estremi agli interni. Questo filo di carbone, e quindi le lampade, durano da 1000 a 1500 ore.

L'impressione che l'esperimento ha prodotto in noi è che il sistema dell'Edison fa entrare nel campo pratico l'applicazione della illuminazione elettrica negli ambienti chiusi e negli usi comuni della vita.

Ieri sera, il pubblico che assisteva allo spettacolo della Scala, ha veduto questa nuova illuminazione nel ridotto, e tutti, ammirandola, constatavano la bellezza della luce, e la mirabile semplicità del sistema Edison. Fu un vero successo.

2030

THE ELECTRIC EXHIBITION.

At length the Electric Exhibition at the Crystal Palace begins to assume something of the attractiveness which the public have been looking for for a month or two past. It is still very far from complete, and the south nave seems in the evening to be enveloped in a gloom all the more dense and dismal from the brilliant display of light at the tropical end and in many of the courts right and left. The work that is going on necessitates we suppose the extinction of the gas on one side of the nave for a considerable distance, and there of course the Palace is decidedly dark; but even at the entrance end, close up by the great clock, where all the usual gaslights are still going, it seems difficult to realise that that is the illumination of the Palace with which its patrons have been satisfied, and which has indeed been described as "brilliant" for more than twenty years. Not only is the gaslight feeble, but it is difficult to avoid the impression that the old gas jets are suffering from a severe depression of spirits, and are burning dimly and smokily in consequence. Messrs. Siemens, who have that portion of the Palace comprising the crystal fountain, are among the most backward of exhibitors; but, when they have completed their preparations, their display will present at least one of the prettiest features in the Palace. They have in position a magnificent brass pendant suspended over the fountain basin, and this, when brilliantly lighted up over the water and the ferns beneath and in the immediate vicinity of the crystal fountain, will certainly have a very fine effect. The Swan Electric Light Company, whose display will be next to Messrs. Siemens', is also in arrear, as well as the next exhibitor beyond, so that the southern end is altogether very incomplete, and, as we have said, in a very gloomy condition. The fact that Messrs. Stride and Co.'s lights are decidedly the most powerful yet set going, and that their display comes next to this dark part of the Palace, tends to give them at present an advantage even greater than the power of their lights entitles them to. This firm has also a considerable assortment of gas lamps on view, a fact which seems to show that they at least do not yet despair of the old system. The central transept is at present only partially illuminated. The great orchestra has its full complement of lamps, and the illumination is very thorough and complete. On the other side of the transept, however, the lamps are not yet going, although they are in position. The northern nave is fully lighted, as indeed a part of it has been for some time past. The fine collection of instruments exhibited by the Post Office attracts a good deal of attention, and arrangements are made for enabling the public to witness the internal working of the Post Office Telegraphs, messages being transmitted from one end to the other of the space allotted, at the rate of 200 words a minute. The operation is watched and scrutinised, but it is very evident that the British public has not yet got very deep into the mysteries of electric telegraphy, and the perforating and transmitting instruments are for the most part given up as riddles beyond ordinary human faculties to solve. There are two or three systems of telegraphy at work, and exhibitors are stationed at them for the purpose of exhibiting their operation.

It is only a very short time ago that the public were continually being assured that although electric lighting might be found available for large open spaces or anywhere where large and powerful lights might be required, it was never likely to be available for interior lighting. Most decidedly the conviction forced upon the minds of all visitors to the Crystal Palace must be that it is the interior lighting that has been brought to absolute perfection, and that something still remains to be done with the larger lights. So far as the quality and efficiency of the light is concerned, the only fault to be found with the powerful arc lights is just an occasional blink or a slight tinge of crimson. The smaller incandescent lights have not the faintest approach to unsteadiness of any kind. There is a cluster of Maxim incandescent lights just at the entrance of one of the richest looking courts on the east side of the northern nave, and the universal verdict must be that nothing can possibly improve upon that light for interior lighting. The incandescent light is in itself somewhat yellow, and in this case a slight tinge of colour in the lamps adds to warmth, and the glow of this on the handsome brass standard and upon the rich gilding and colour of the court in which it is placed, affords altogether a very rich and sumptuous effect.

At present, however, the palm must be awarded to Mr. Edison's display. His section of the exhibition is apparently complete, and it cannot be questioned that the display he furnishes settles finally all doubt as to the triumphant success of electricity for interior lighting. We shall not, of course, be understood to be expressing any opinion with regard to considerations of expense, but so far as the nature of the light and its applicability to every possible requirement of domestic use are concerned, it is difficult to avoid speaking of this display in terms which may savour of enthusiasm, if not of exaggeration. The concert room is entirely lighted by electric lamps, and the great merit it is intended to present, we suppose, consists in the illumination having all the best characteristics of gas lighting, and absolutely none of its defects. There are festoons of small lamps, perhaps 150 of these round the galleries, there is a cluster of them in a crystal pendant hanging from the roof, and there are a few lights dispersed under the galleries. Altogether the effect is that of gaslight, only more brilliant. There is none of the ghastly whiteness that used to be felt a fault, but just a soft, brilliant yellow light, and to show the possibility of diminishing the light to any point, Mr. Edison's name is exhibited over the organ in small lamps, appearing, as seen from the body of the hall, to be presented on a board of about a yard long and a foot wide. The entertainment hall, on the other side of the Palace, however, is the crowning triumph of this inventor's system. There is an enormous gilt pendant in the centre of the room, lighted up by about a hundred lamps, and about the room are pendants, brackets, table-lamps, &c., in all sorts of forms, some of them arranged to permit of visitors testing for themselves the facility with which the light may be turned on and off, a tap, just as in the case of gas, affording the means both of extinguishing and relighting. There is at one end of the room a large billiard-table, beautifully lighted up, and at the other a miniature theatre stage. This entertainment hall is really a magnificent display of a system of lighting beyond which it is impossible to conceive of an improvement, and assuming that it can be carried on at a cost approximating to that of gas, its universal adoption must be held to be an absolute certainty, and that in a very short time.

2033

THE MANUFACTURE OF EDISON LAMP CARBONS, AND LAMPS.

(For description see page 117.)

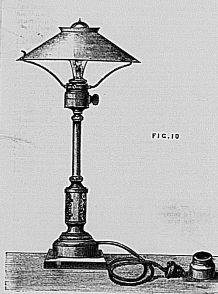


FIG. 10

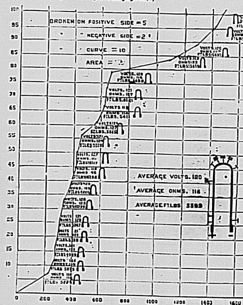


FIG. 3.

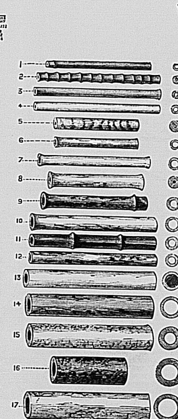


FIG. 1
SAMPLES OF BAMBOO

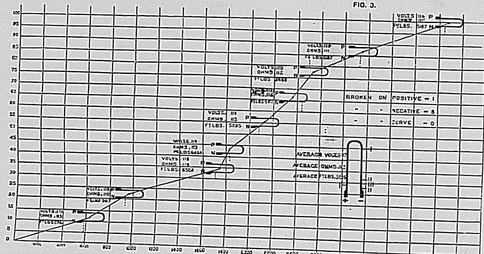


FIG. 4.

FIG. 7
WALL BRACKET
JOINT A.

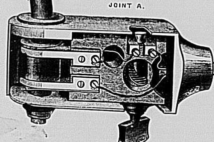
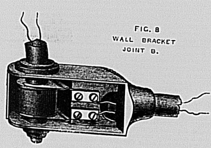


FIG. 8
WALL BRACKET
JOINT B.



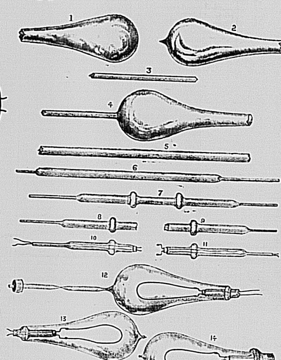


FIG. 5
PROCESSES IN THE MANUFACTURE OF THE LAMP

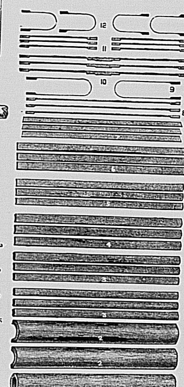


FIG. 2
PROCESSES IN THE MANUFACTURE
OF THE CARBONS

2033

THE EDISON LIGHT.

In *Chambers' Journal*, and in some of the technical papers for July, 1863, there is to be found an article on the electric light. This article, like all others of its kind, is extremely interesting, dealing as it does with the history of the subject. The literature on the theory of the subject is interesting to another class of readers. In this article the work of Messrs. Greener and Staite, exhibitions of which were given in 1847 at several places in London, is discussed, and the following sentences are instructive:—"They devised a mode of enclosing small lumps of pure carbon in air-tight vessels, and rendering them incandescent or luminous by means of galvanic electricity." Other lamps involving a train of clockwork to keep the relative position of the carbon points constant were devised. Of such we read—"But these ingenious inventors, notwithstanding all their praiseworthy endeavours, could not obtain a steady light: it *would* flicker and intermit, and failed to become practically useful, although they fondly hoped—as they declared—that streets and buildings might thus be lighted at one-sixth the cost of gas." Even if the light had been steady, and thus have commended itself, the mathematicians with their cool calculating power, and to investors seemingly cynical results, soon showed that the burning of zinc to produce the electric light was far from economical, and could not because of its cost come generally into use. Time went on. Dynamo-machines replaced the galvanic battery; the electric current was cheapened by the combustion of coal as the first cause, instead of zinc; the electric world was moved to its vitals by certain successes; yet the old idea of incandescent lighting was pooh-poohed till Messrs. Swan and Edison showed us to be wrong. Swan experimented off and on for twenty years. Edison commenced, we believe, after the Eclipse expedition a few years ago, during which a sensitive instrument of his had been on trial. The Wallace-Farmer machine excited his inventive faculties, and he turned to test the possibilities of electric lighting. He passed through the ordinary course of experiments with the more infusible metal, and at length came to the conclusion, as every other experimenter before and since has come, that carbon, and carbon only, was the substance to be used. We wonder who will be the first to discover a real rival to carbon? Having decided to use carbon, the next question was the material from which the carbon should be obtained. A process of differentiation soon showed that vegetable carbon only was useful, and that obtained from grasses was selected. From north and south, from east and west, materials were obtained and tested. We illustrate, on page 118, specimens of bamboos brought from South America, Japan, &c., for the purpose of these trials. Each bamboo was exhaustively tested, till at length a certain one was selected for use. The following are the names of the canes illustrated in the figures:—(1) Hauchikee, from Japan; (2) Nebuchitakee, from Japan; (3) Shiho Jikee, from Japan; (4) Sugar Cane, from Venezuela; (5) Horteichikee, from Japan; (6) Kuraichikee, from Japan; (7) Matakee, from Japan; (8) Brazilian, from Para, Brazil; (9) Hauchikee, from Japan; (10) Shikakuakikee, from Japan; (11) Mountain Bamboo, from Japan; (12) Shikakuakikee, from Japan; (13) Brazilian, from Para, Brazil; (14) Shikakuakikee, from Japan; (15) Japanese, from Yokohama, Japan; (16) Torachikee, from Japan; (17) Chinese, from Hong Kong, China.

When the selection had been made, the method of manufacture was carefully considered and every detail arranged, so that the manufactured article should be produced at the lowest cost. Fig. 2 shows the processes of manufacture. The bamboo is taken of proper length 1, and split into two parts 2, 2. Each of these parts is divided into three smaller parts, which are pared down to separate the pithy from the stronger fibrous texture, shown in 3, 4, 5, 6, and 7. When No. 7 stage is arrived at the strip is cut in the shape shown in 8, the thicker ends being so left to obtain good contact, or shaped as in No. 10, when carbons for the smaller lamps are required. Each strip in No. 10 forms two, as in No. 11. The next stage to Nos. 8 and 11 is the carbonisation of the fibre.

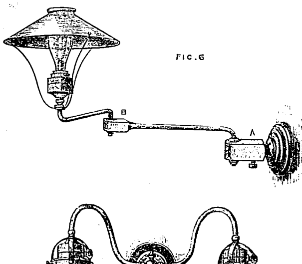
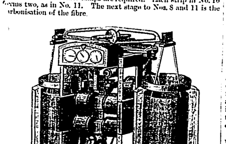


FIG. 6

FIG. 9



EDISON WEBER METER.

Of course, the process of carbonisation is of somewhat a delicate nature, and care has to be taken, or the previous work might easily be spoiled. The filament, as we have said, is shaped before the carbonisation. The filament shaped as Nos. 9 and 12 is laid in a groove cut in a metal case—generally the metal used is nickel—which groove is covered to render it air-tight, and so prevent combustion. The filament so protected is placed in the furnace and raised to the temperature required.

To show how exhaustively Mr. Edison carries out his experiments we give diagrams Figs. 3 and 4, showing tabularly how the information as to the better materials was obtained. Fig. 3 shows an example of a bad material, Fig. 4 of a good one. These diagrams are very instructive, showing as they do the time after which the carbon broke, under what current and at what points. The processes in the manufacture of the lamp itself are very simple. The lamp consists primarily of two parts, one the central stem, as shown in Fig. 5, No. 11, of glass into which are fused the conducting wires, to the ends of which the carbon filament is fixed as in Nos. 12, 13, 14, the other the globe proper. The lamp is exhausted from the top, and when exhausted sealed to prevent entrance of air. One conducting wire is in contact with the screw at the lowermost point of the lamp, whilst the other is in electric contact with a brass ring around the rim of what we may call the stem of the lamp. No. 4 shows how the exhausting tube No. 3 is fixed to the globe No. 2, whilst Nos. 5, 6, 7, 8, 9, 10, 11, show the processes undertaken to form two of the inner stems.

We have thus far followed what seems to be the natural order of things—we have shown in previous papers the arrangements made for the generation of the current, and for its safe conduction through mains to the houses. The lamp wires are so arranged that it seems almost impossible for any accident to happen. A strip of wood, say 3in. by ⅞in., has two grooves cut into it to hold the insulated wires, say to a lamp on a wall bracket. This lamp bracket may be of the design shown in Fig. 6, and hence movable around a centre. Sections of the joints at A and B are shown in Figs. 7 and 8. It should be understood that every lamp and every house is provided with a fusible conductor, so that should any mishap cause a greater current to flow into the conductors to the lamp, fusion at the safety point takes place and the current is absolutely stopped. The lamp is rendered useless; but who would care about a gas burner being temporarily useless if it automatically stopped a leakage of gas, and so prevented an explosion.

The current can be turned on or off the lamp by means of a tap, so that in many respects the householder who could go to sleep overnight with gas laid on, and wake up in the morning with the electrical connections made, would go about the work of getting his light just as he had always done. Figs. 9 and 10 show lamps adapted for pendants or to stand on the table, &c. A further similarity exists in the distribution of electricity and gas, inasmuch as the amount consumed of the former as well as of the latter can be measured. Fig. 11 shows the latest form of meter. The laws pertaining to electro-deposition of metals are herein utilised. It is well understood that a given quantity of electricity, whether passing in a shorter or a longer time, will deposit a certain weight of metal. The apparatus then consists of two cells placed in a shunt or branch circuit. The amount of electricity passing through this circuit in proportion to that through the main circuit is known, and hence the weight of metal deposited tells the quantity of electricity that has passed through the circuit. In practical use certain precautions are taken to counteract the effects of heat in the circuit, somewhat after the same fashion as in watches, two metals are used, expanding differently under the influence of heat. In the cell, for example, a rise of temperature decreases the resistance, and a compensating arrangement is therefore made in the circuit by inserting, say, a copper resistance, which resistance increases as the temperature rises. Another form of meter was described in our issue of November 4th, 1881.

With reference to this method of measuring electrical currents we may call attention to the admirable series of experiments undertaken by Dr. G. Gore, F.R.S., which supplies information regarding the degree of accuracy of such experiments when made by means of electrolysis of a solution of cupric sulphate, and states the conditions under which the degree of inaccuracy of measure is the least.

THE ROYAL INSTITUTION.

THE ABSORPTION OF RADIANT HEAT.—LONDON FOG.

On the 3rd inst. Dr. John Tyndall, F.R.S., lectured at the Royal Institution, Albemarle-street, on the "Absorption of Radiant Heat." Mr. William Spottiswoode, F.R.S., presided.

Professor Tyndall began by saying that some of the greatest superstructures of physical science depended upon a more or less ideal foundation. For instance, the undulatory theory of light could only be spiritually discerned, for the waves were far too small to be seen; it also required a mind of high ideality to conceive an ether filling all space, yet possessing the qualities of a solid. The ultimate atoms of matter stood upon the same ideal foundation. When several of these atoms were grouped together they were scientifically knownas "molecules;" and the object of his address that evening was to explain the action of free molecules upon obscure radiant heat. By free molecules he meant the molecules in gases, vapours, and liquids. The invisible waves of radiant heat were longer than those of light, but inconceivably small; and there was a vast difference in the power of different kinds of free molecules to absorb these heat vibrations. They could do most in this way when they were chemically united. If a simple mixture were made of nitrogen and hydrogen gases, in the proportion of 14 to 3, and placed in a tube of wide diameter, through which a beam of obscure heat could be sent, scarcely any of that heat would be absorbed by that mixture. But if the same two gases were chemically united to form ammonia, they would stop a thousand times more radiant heat than before. It was the same with vapours. Some were as black as pitch towards radiant heat; others were highly transparent. If the number of molecules of the gas in the experimental tube were constant, the absorption of radiant heat was the same, no matter how the molecules were crowded together by the lengthening or shortening of the tube. But the molecules might further be so crowded together as to form a liquid. On trying experiments with a number of vapours, also of liquids from the same vapours, he found the mean absorption of radiant heat by the one to be 32·5, and by the other 32·9, the number of molecules being the same; so that the absorption by a liquid of its vapour is practically equal. The law is that the absorption of radiant heat remains constant through all changes between the vaporous and liquid conditions.

The speaker then stated that when impulses of light, made, say, by passing rays from the lime-light through perforations in a rotating disc, were allowed to impinge upon a small glass bulb containing vapour, sounds were given forth by the vapour, and the noise could be conveyed to the ear by means of an india-rubber tube from the mouth of the flask; the sounds were then like an ordinary organ peal, and were due to the absorption of radiant heat by each vapour tried. Some men of science had denied the accuracy of his discovery that aqueous vapour was such a powerful absorbent of radiant heat; he asked a bottle of aqueous vapour whether he was right as to its absorbent powers, and the vapour sent him a musical roar in reply. The sound was evidence that radiant heat had been absorbed.

The obscure radiation from the electric arc is eight times greater in heating power than the luminous radiation; the obscure radiation from the sun is twice that of the luminous radiation. A layer of water placed in the path of the electric light makes its radiation very much like that of the sun. Between ourselves and the sun is the aqueous vapour of the atmosphere, but at a height of 10,000ft. or 12,000ft. there is very little vapour in the air. Professor Langley, who was making observations in California at a height of 12,000ft., had just written to him saying that he found a great difference in the distribution of the solar radiation at that altitude; there was an enormous expansion of the ultra-red spectrum.

Last Friday night, in the course of a lecture at the Royal Institution, Professor Edward Frankland, F.R.S., said that the suspended matter in the atmosphere is mostly below the height of 5000ft.; probably half of it is below that level. The higher the position in the atmosphere, the smaller are the variations in solar intensity. The lower the latitude the greater might it be expected to find the intensity of the sun's rays, but this is not necessarily the case. In northern regions, coupled with the conditions of high elevation, light background, shelter, clear atmosphere, and a small quantity of aqueous vapour in the air, the solar intensity may be great. The chief evils of a town climate are—great heat in summer, gloom in winter, and so much dirt in the air, that the colours of new or freshly-painted houses soon change to a grimy hue. The darker the houses the warmer they are inside, and the cooler are the streets, and more especially is this the case in relation to the roofs; slate roofs sometimes became so hot in the sun that the hand can scarcely bear to touch them, but if they were made white outside they would be as cool as the external air. All the large towns in England are near the sea level—a condition which favours air warmth, but not direct solar warmth. The combustion of coal in towns results in the discharge into the atmosphere of vast quantities of soot, tar, and steam; the more perfect the combustion, the less tar and the more steam is given off. Mr. Robert Hunt estimates that eight millions of tons of coal are consumed annually in London, and that of these six millions of tons are consumed in the winter months, consequently the amounts of steam, soot, tar, and sulphurous acid discharged into the air are enormous. Steam supplies the basis of all fog; and the fog particles become covered with tar, which renders them more permanent; dirt in the air is necessary to produce fog. To illustrate these points Dr. Frankland took a large flask containing a little vapour of water, and with air deprived of dirt by being filtered through cotton wool; on chilling this air by expansion by means of a few strokes of an air-pump, slight mist was formed which disappeared in a moment. The effects were rendered visible throughout the theatre by means of a beam of light from the electric lamp, thrown upon the flask. The ordinary air of the theatre with its normal charge of dirt was then admitted into the same flask, and when the former experiment was repeated the fog was more dense and lasting then when air without dirt had been used. The presence of sulphurous acid in London air promotes fog, and the power of the acid to do so was proved by the lecturer by experiment. Tarry matter in the air renders fog more persistent by retarding evaporation. The power of tar to do so is recognised by some manufacturers, and used by them to economise fuel, while keeping water at the boiling point. Professor Frankland here exhibited one basin of water at the boiling point giving off its clouds of steam, and another basin of water at the same temperature giving off none at all, because the water was covered with a thin layer of olive oil, which the speaker stated to be the same in its influence under the circumstances as a thin layer of tar. Thus the products of combustion of our household fires, he said, furnish potent sources of fog, and it is a mistake to lay the blame on the discharges from the chimneys of manufacturers. If all manufactures were removed from London, no appreciable difference would be made in the amount of fog.

At the South Kensington Smoke Abatement Exhibition, he said were two great classes of grates for domestic use, namely, those which burn bituminous and those which burn anthracite coal. There are about 600,000 houses in London, and little good in the way of preventing fog will be done by improved fire-grates, he added, so long as householders use bituminous coal. There is one remedy and one only, and that is to stop the importation of bituminous coal into London. The price of anthracite coal is lower than the other, it is smokeless, and an ample supply of it and of smokeless steam coal can be had from Wales. Bituminous coal can also be rendered smokeless by coking; moreover, in the process of coking it gives off valuable commercial products. The difficulty in lighting anthracite or coke fires is overcome by Mr. Siemens' process; by an expenditure of two shillings each, every grate in London can be made to burn smokeless coal. He had proved this in his own home in spite of the grumbling of the servants at first, before they had gained experience in lighting the fires; the cost had been three shillings per grate, including blowers to facilitate lighting. The general adoption of such a system would do much to abolish the more injurious of London fogs, which always increase the death rate, more especially among persons suffering from bronchitis, asthma, and other diseases of the lungs. A cotton-wool respirator does much to prevent the choking sensation caused by London fogs, but it does not alleviate the smarting of the eyes. In any case, he added, we have little sunshine in this country, and need not make matters worse by throwing a dark unhealthy pall over ourselves!

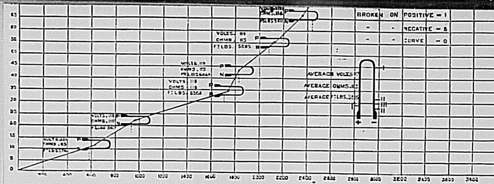


FIG. 4.

FIG. 1
SAMPLES OF BAMBOO

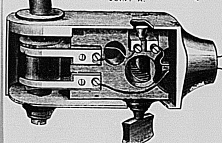


FIG. 7
WALL BRACKET
JOINT A.

2033

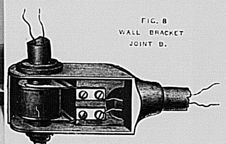


FIG. 8
WALL BRACKET
JOINT B.

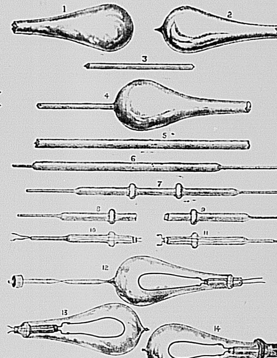


FIG. 5

PROCESSES IN THE MANUFACTURE OF THE LAMP

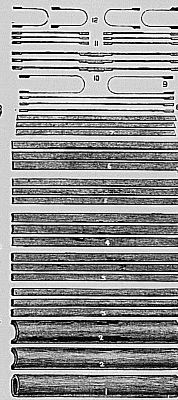


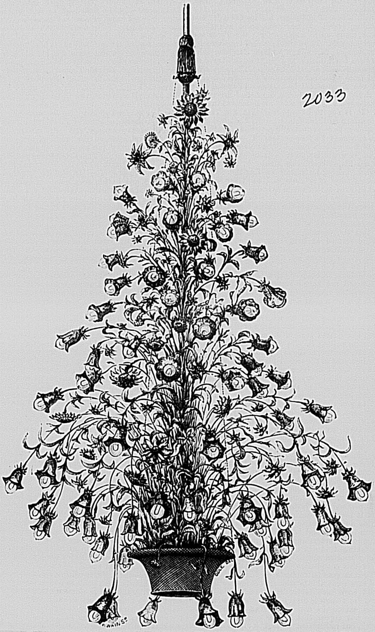
FIG. 2
PROCESSES IN THE MANUFACTURE
OF THE CARBONS

2035

ELECTRIC CHANDELIER.

MADE BY MESSRS. VERITY AND SONS, KING STREET, COVENT GARDEN.

2033



39

CRYSTAL PALACE ELECTRICAL EXHIBITION.

The centres of attraction outside of the transepts will be the Picture Gallery, illuminated by Swan lamps, and the Concert and Entertainment Courts, illuminated by Edison lamps. We shall deal hereafter with the systems above-mentioned, as well as others which may have escaped this rapid review. Meanwhile we may call special attention to an accessory of the electric light, as it will show that, should Mr. Mattieu Williams be mistaken as to its future, the industrial branches dependent on gas may expect further developments, requiring a variety of designs and good workmanship. We refer to a chandelier especially designed and made by Messrs. Verity and Sons, of King-street, Covent Garden, for Mr. E. H. Johnson, of the Edison Light Company. This is placed in the Entertainment Court. It represents a huge basket of flowers and is made wholly of hammered brass. Its height is 15ft., whilst it measures 9ft. across. The flowers represented—of which there are about 350—are the large sunflower, the narcissus, the tiger lily, the orchid, &c., down to the small clove pink. Edison lamps are placed within the cups of the flowers. There are ninety-nine such lamps in three circuits, and when lighted, the light of the lamps and the blending colours of the glass cups are effective. The brass representing the stems of the flowers is of course hollow, and the thousands of pieces are so arranged that comparatively little difficulty was encountered in wiring the lamps. Our illustration has been engraved from a free-hand drawing specially taken for us. The lamps in each circuit can be turned on or off as required.

2040

IL PUNGOLO Feb. 18'82 Milan

Fra le coso riuscitissime citeremo anzitutto la luce elettrica che illuminava la sala principale del Ridotto, applicata dall' ingegnere Shepherd, che è il rappresentante in Italia dal celebre Eddison. L' esperimento di ieri sera ha dimostrato *luminosamente* che il problema della illuminazione elettrica è finalmente risolto, e noi dobbiamo ringraziare il signor Shepherd se la nostra Milano fu la prima città italiana in cui furono applicate con tanto successo le nuove lampade, con le quali la luce viene distribuita in piccole fiammelle a cui fu tolta ogni intermittenza, come fu tolto quel pallore sidereo inerente alla luce elettrica e che inspira melanconia.

2041

IL NUOVO TRAMWAY N. 184. Feb 18/82

Riesposizione-Veglia alla Scala

2044 Pare proprio che sarà un finimondo stanotte alla Scala. Il Programma del Comitato dice che alle ore 10 e mezza si spalancheranno i battenti del teatro e la folla irrompente si troverà davanti alla facciata dell'Esposizione, di tela e calce come l'originale. Dalle porte si vedrà la *fuga* delle Gallerie: in fondo la Sala Pompejana.

Nel ridotto la luce elettrica dell'americano Edison, espressamente scritturata per la circostanza, e presentata dal bravo Shepherd, illuminerà l'Esposizione industriale fatta a colpi di pennello — tra un uscio e l'altro le Gallerie del lavoro e piccole industrie. Filande e annesse procaci filandiere, difese da appositi ripari contro i troppo ardenti ammiratori. — Arti liberali — Telegrafi — Telefoni — Pesi e Misure — Apparati ortopedici — Cremazione — Chirurgia — Negromanzia, ecc.

Ci sarà una grande Esposizione Musicale organizzata dalla *Società Orchestrale Gambolottina* con veduta d'istrumenti, di tutti i tempi e di tutti i luoghi, a doppia, a tripla e quadrupla tonalità. Esecuzione dell'*Inno Comunale* di Gambolò, seguito da Concerti vocali e istrumentali. Vendita dello splendido *Album Musicale Faccio-Gomez-Ponchielli.*

2045

2048

LA LOMBARDIA

La luce elettrica di Edison. — L'egregio ingegnere James Shepherd ha in questi giorni fatto dono all'Istituto tecnico di S. Marta e all'Istituto tecnico superiore di quattro lampade Edisón a incandescenza.

Sappiamo eziandio che l'illustre cav. professor G. Colombo intenda tenere una conferenza sopra questo soggetto nella Sala del Ridotto alla Scala, illuminata colle lampade Edisón anche in quella circostanza.

L'Edison, il genio di Menlo-Park, può dirsi il Prometeo moderno, ed ha trovato in Italia un apostolo fervente e pieno d'abnegazione nello Shepherd, che non risparmia nè cure, nè fatiche, perchè la luce elettrica trionfi tra noi.

L'esperimento della luce Edison fatta venerdì notte nel Ridotto della Scala ha dimostrato che il problema della luce elettrica è risoluto e che non resta se non farne sopra grande scala l'applicazione.

Lo Shepherd, che ha assunto il difficile còmpito di diffondere la luce Edison tra noi, siamo certi che colla pertinacia del suo volere riuscirà a trionfare delle molte difficoltà che senza dubbio gli si opporranno.

L'Edison non poteva trovare un più intraprendente, operoso e tenace rappresentante in Italia dell'ing. James Shepherd.

Questi ha già iniziato uno stabilimento in cui farà l'applicazione del nuovo sistema di luce elettrica.

Sappiamo che l'Edison intende visitare l'Italia e vuol vedere Milano, città che per la prima fe' plauso al suo sistema.

E noi applaudiremo a lui, che a soli trentacinque anni ha date già tante prove del suo genio creatore.

L'Edison è nato il 10 febbraio 1847.

Il Sole — Mercoledì, 22 Febbraio 1882 — Milano

2052.

CRONACA CITTADINA

La luce Edison a Milano. — Il distinto prof. cav. G. Colombo terrà fra breve una conferenza sopra l'illuminazione elettrica, sistema Edison, introdotta in Milano, con tante prove ed esperimenti riusciti a meraviglia, dall'egregio ed infaticabile James Shepherd, il quale volle in questi giorni fare un dono all'Istituto tecnico di S. Marta e all'Istituto tecnico superiore di quattro lampade Edison a incandescenza.

La conferenza sarà tenuta nelle sale del Ridotto al Teatro della Scala, le quali verranno come le sere precedenti, illuminate da lampade Edison di un sistema semplicissimo e projettanti una luce tanto limpida e chiara da confondere qualsiasi altra luce.

La lampada Edison infatti dà una luce calda, vivida, fissa, che non altera i colori del viso, nè delle vesti; il bleu, il rosa, per esempio, restano bleu e rosa, e non paiono, come col gas, verde e vermiglio.

La prova del Ridotto della Scala persuade della opportunità d'illuminare, non solo una sala, ma tutto un teatro, compreso il palcoscenico; poichè, data la facilità, come è il caso di questa luce, di moderarla a piacimento e di darle anche le tinte che meglio convengono, parrebbe risoluto il problema delle esigenze degli spettacoli, e tolto il calore (e il toglierlo dai lumi della ribalta sarebbe un naturale vantaggio per gli attori e i cantanti), vien tolta la causa principale d'incendio.

L'impressione che l'esperimento ha prodotto in noi e tutti i presenti è che il sistema dell'Edison, introdotto fra noi dall'ingegnere Shepherd, fa entrare nel campo pratico l'applicazione della illuminazione elettrica negli ambienti chiusi e negli usi comuni della vita.

Anzi il signor Shepherd, che si è assunto con ferrea volontà il difficile compito di diffondere la luce Edison in Italia, colla pertinacia del suo volere riuscirà senza dubbio a trionfare delle molte difficoltà che gli si oppongono, e l'Edison non poteva trovare un più intraprendente, operoso e tenace rappresentante.

James Shepherd ha già iniziato in via Stella uno Stabilimento in cui farà l'applicazione del nuovo sistema di luce elettrica, e l'Edison visitando l'Italia e Milano, farà senza dubbio plauso al suo carattere fermo e perseverante.

Attualmente si tiene a Londra una esposizione d'elettricità cui tutte le Compagnie sono rappresentate, e, quantunque l'installamento sia incompleto, vi funzionano 2000 fiamme. Ebbene l'Edison vi alimenta 2'4 globi con una macchina a vapore d'una forza di 25 cavalli ed il suo sistema porta la palma su tutti gli altri e siamo certi che anche a Milano l'illuminazione elettrica con questo sistema farà, stante la sua eccellenza, continui progressi e verrà giorno in cui teatri, pubblici stabilimenti, istituti, negozi, caffè e case private verranno illuminati con la luce elettrica di Edison.

L'Edison, il genio di Menlo-Park, può dirsi il Prometeo moderno, ed ha trovato in Italia un apostolo fervente, e pieno d'abnegazione nello Shepherd, che non risparmia nè cure, nè fatiche, perchè la luce elettrica trionfi.

2055

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting Companies having Bills in Parliament must begin to repent of their haste. Opponents are springing up on all sides, and the grounds of opposition show a wonderful power of multiplication. It is now announced that the Metropolitan Board of Works have so far turned upon the nursling of their choice that they will demand the imposition, in all the Bills, of clauses which, as we believe, will render these measures useless to their promoters. The principal requirements of the Board may be summarized in the most intelligible form by saying that it is desired to place the electric lighting supply on the same basis as gas lighting. It is thought necessary that there should be an obligation to supply all public and private consumers; and that the price to be charged and the quality of the light, as well as the dividends to be paid by the Companies should be fixed, subject to revision by the Board of Trade. The reasonableness of these stipulations cannot be gainsaid. The Gas Companies have to conform to similar and stronger regulations, and if the electricians are not in a position to accept them, it will show that their pretensions for legislative facilities are as yet unwarranted. With another demand of the Board we cannot so freely sympathize; and that is the proposal to make a charge for the use of the subsoil of the thoroughfares. This claim is unwarrantable by any precedent, and is fraught with danger to the interests which require the use of public highways. If it is to the general advantage that permission should be granted for the use of the public roads by any trading organization, then this privilege should be given freely, looking to the payment of rates by the undertakers as the sole recompense. The Board might as well insist upon the payment of fees by a stage-coach proprietor for his use of the surface of the roads, as to specifically tax a trader of another class who is allowed a privilege with a view to the ultimate benefit of the population. The Metropolitan Board, to give them credit for their principles, do not usually err in asking too little; and we doubt not that in this case they will be content to demand the conformance of electric lighting speculators to reasonable restrictions, in which course the Board will find themselves allied with company not always to be found acting with them, and, more important still, in unison with the wishes of corporate authorities throughout the Kingdom.

The current number of *Blackwood* contains an article on Electric Progress, which might have been written in Balmain's luminous paint, so free is it from shadows. A great portion of the commencement is devoted to an attempt to show, with what success need not be stated, that the slow progress of electric lighting is traceable to the inherent conservatism of the scientific mind. The article then goes on to state in the vaguest manner that a "water-wheel, by being "employed to generate electricity, may light our rooms, "cook our dinner, and ripen our peaches," and much more of the same sort of information. (?) It might be thought that the style of writing commonly known as "gush"—which may be defined as the modification of facts to suit a strong and not very clear imagination—is only to be found in certain notorious newspapers. Of late years, however, the once calm and scholarly magazine editor has apparently been constrained to cater to the public taste for florid reading; and such articles as the one in question are the result. The use of the subjunctive mood is very marked in this communication, things "may" be done, wonders "may" be seen, and the universal adoption of electricity for every kind of service "may" be expected. Unfortunately, however, for his confiding readers, the writer has omitted to qualify these shadowy assertions of possibility by reference to time and place. As may be expected, he makes great capital out of the lighting of the Savoy Theatre, but is presumably not aware of the fact that the gas bill of this establishment is about as heavy as that of any similar place of amusement where no electricity is favoured, and that the expenses for limelight are probably higher than elsewhere.

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It is reported in the New York newspapers that considerable inconvenience and damage to the property of the Fire Commissioners was recently caused by the accidental contact of a wire of the United States Electric Lighting Company with one of the fire-alarm telegraphic circuits. The lighting wire had originally been insulated, but it had become stripped bare by vibration and oscillation. The point of contact was barely one-sixteenth of an inch wide, but the effects were widespread and peculiar. Many of the fittings of several alarm-boxes were fused and otherwise damaged, and the circuit was thrown out of action. Extra patrolmen had to be employed in consequence, and it is stated that serious injury would have followed any attempt on the part of the firemen to use the apparatus in the ordinary way. The Commissioners have now repented of the carelessness which permitted the Electric Lighting Company to lay down their wires regardless of the consequences to public property; and they are therefore inquiring of Counsel how the operations of the Company can be restrained or controlled in the public interest. The New York authorities were scarcely wise in time, as our own Metropolitan Board of Works propose to be in somewhat of a similar case.

The fallacy of theoretical estimates of the cost of electric lighting was exposed by Mr. Harry Jones in the course of the discussion, at the Institution of Civil Engineers, on Dr. Paget Higgs's paper on the candle power of the electric light, to which reference was made in one of our "Notes" last week. As we have already stated, this paper gave a comparison between the cost of incandescent electric lamps and gas lighting in New York, in which the former had an apparent advantage. Mr. Jones remarked that when the electricians get a business established for lighting it will be found that sundry heavy charges, now conveniently ignored, will attach to their operations as to those of gas manufacture. He stated that the rates and taxes, cost of collection and book-keeping, distribution expenses, cost of inspection, and so on, amount in the case of a large Metropolitan Gas Company to three-fourths of the net cost of coal. It is notorious that when electricians condescend to give any particulars at all respecting the cost of electric lighting, they take the theoretic amount of energy consumed in the lamps, and state a value for the horse power required, irrespective of the business charges which Gas Companies and other traders have to bear. It is well that this presumptive deception should be continually exposed, as it is ever being paraded afresh.

As will be seen in another column, we have received a formal challenge on the subject of our strictures on the Mr. C. C. Ruthrauff whose communication to *The Times* on the subject of American successes in electric lighting was criticized in the JOURNAL of Oct. 18 and Nov. 19 last. We therefore publish together the attempted justification of this personage and our original information, assuring our readers that no little entertainment as well as instruction will be derived from the perusal of these documents. It should be remarked that Mr. Ruthrauff, upon his return to the States last winter, wrote a short note to an American *quasi*-scientific

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journal, ascribing wonderful progress to electric lighting in London and Paris! Further comment on this remarkable man and his proceedings may well be deferred.

A first notice of the Electrical Exhibition at the Crystal Palace appears in another column, and will perhaps be found specially interesting by the members of The Gas Institute who may contemplate visiting the exhibition, under the auspices of the President and Council, on Tuesday next. The circular containing the invitation to the proposed gathering states that the exhibition, is expected to be in order by this date. This is probably correct, inasmuch as very little is now wanting to make the show as complete as it ever will be. It is proposed that the members of the Institute should assemble at the Palace on the afternoon of Tuesday next, in order to inspect the machinery and fittings for generating electric light. Subsequently, at dusk, the various lamps will be seen in operation, and, at a dinner to be afterwards held, it is suggested that the visitors should be invited to exchange opinions concerning what they have seen. This is, in brief, the programme of what should prove an instructive day; and it may be expected that there will be a sufficient response to the initiative of the President and Council.

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SOME NOTES FROM AMERICA.

(FROM OUR OWN CORRESPONDENT.)

Jan. 23, 1882.

The period that has elapsed since my last letter has had its usual quota of accidents chargeable to the electric light. In Denver, Col., an *employé* of an electric light company was adjusting a lamp over the entrance of a store, and happening to take hold of the wires, received a severe shock. The man fell to the pavement below, and was badly injured. In Philadelphia, where the electric light is being experimented with for street lighting, a couple of accidents have occurred owing to the wires coming in contact with telephone wires. In neither case was there any serious damage done; still, accidents from this cause are becoming too frequent.

It is reported that Mr. Edison has nearly completed, at Menlo Park, an electric railroad, three miles in length, which is to be used to demonstrate practically the economy of electric over steam railroads. If he perseveres in his attempt to light part of New York with his incandescent lamps, it will certainly be curious to watch how the current used by the several consumers will be measured to the satisfaction of the customers. At present, so far as I know, the only instrument he has for this purpose is his meter, so called, the *rationale* of which is that a certain part of the current supplied to any building is caused to pass through a couple of cells containing zinc plates, which are removed at stated times and their increase in weight noted.

The United States Illuminating Company claim to have produced a more agreeable arc light than any other in use. The advantage claimed for it is the absence of the unpleasant violet rays in the light produced, which is accomplished by lessening the distance between the carbons, thus having a small arc.

There is the usual amount of cheap talk going the rounds of the daily press throughout the country relative to the probable formation of companies to supply electricity for the lighting of dwellings, &c. A prominent Boston paper recently stated that electricity could be supplied for lighting, by the incandescent plan, so as to compete with gas even if the price of the latter were 96 cents (4s.) per 1000 cubic feet. Of course such an idle statement, unsupported by figures, would be unworthy of notice, were it not for the fact that it is just such items that cause the timid and uninformed holder of gas stock to sacrifice his investment. One of the most recent electric light schemes is a proposition to light one of the entrances of New York Harbour, popularly known as Hell Gate. Already a Bill has been introduced in Congress appropriating 20,000 dols. for the erection of the necessary electric lighting plant. It is, however, hardly possible that the Bill will be passed.

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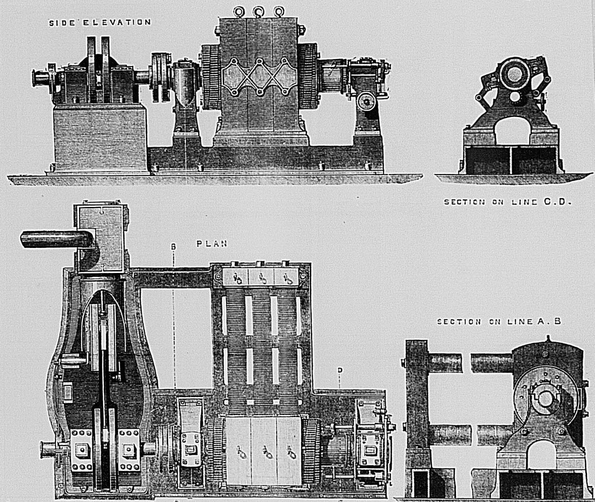
SIDE ELEVATION
SECTION ON LINE C.D.
PLAN
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SECTION ON LINE A. B

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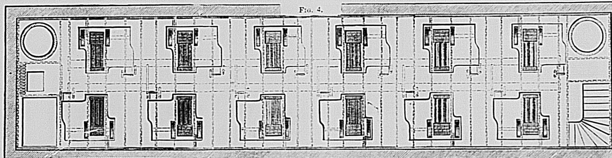
Fig. 4.



PLAN OF MACHINE ROOM

Fig. 3.

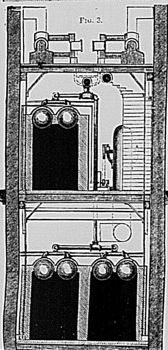
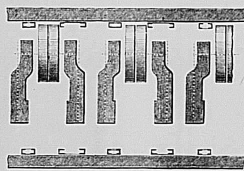
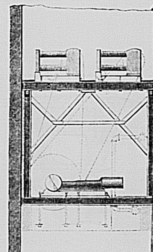


Fig. 1.



PART PLAN OF ENGINE FLOOR

Fig. 2.



TRANSVERSE SECTION
THROUGH ENGINE & MACHINE ROOM

LA PERSEVERANZA DI MERCOLEDI', 22 FEBBRAIO

2070

La luce elettrica applicata ai treni. — Sulla ferrovia Londra-Brighton fu fatto l'esperimento dell'illuminazione d'un vagone per mezzo dell'elettricità. Poichè esso riuscì, un treno intero, rischiarato con lampade Edison ed interamente composto di vetture di lusso, circola ora su quella linea, dove l'affluenza dei viaggiatori è sempre grande.

Il nuovo treno di Brighton è un vero albergo in circolazione.

In questo treno rapidissimo, formato di tutta una serie di salotti e di camere, elegantemente ammobigliati e scintillanti di luce elettrica, il viaggiatore può passeggiare a proprio agio da un capo all'altro del convoglio. Se desidera fumare, può sedersi su belle poltrone in mezzo ad una sala speciale; se vuol desinare, havvi un'apposita sala dove le sedie sono disposte come in un vero ristorante; vi sono inoltre gabinetti di toletta, di bagno, ecc.

Ma la maggior attrattiva è ancora quella dell'illuminazione elettrica durante la notte.

Decisamente Edison giungerà a farci parere il gas ciò che già ci paiono le candele di sego — un mezzo di illuminazione antiquato.

Il Sole — Giovedì, 23 Febbraio 1882 — Milano

2071

La luce Edison nei treni. — Sulla ferrovia Londra Brigton venne fatta la prova dell'illuminazione elettrica secondo il sistema Edison in un intiero treno, ed essendo riuscito perfettamente si continua ad usarla con grande soddisfazione dei viaggiatori. Il nuovo treno di Brighton si può quindi dire un vero albergo in circolazione essendovi adottate tutti gli altri comodi indispensabili per renderlo tale.

La maggior attrattiva però è sempre quella della illuminazione Edison, la stessa che anche qui a Milano, per opera del infaticabile Shepherd, venne con ottimi risultati applicata alla sala del Ridotto della Scala e che ben presto verrà forse estesa anche a tutto il teatro ed altri stabilimenti pubblici e privati. Decisamente il sistema Edison giungerà a farci parere il gas — ciò che già ci paiono le candele di sego — un mezzo di illuminazione antiquato.

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CORRIERE SCIENTIFICO

La luce elettrica Edison. — Si pretende che l'omai celebre e popolarissimo romito di Menlo Park abbia detto un dì ad uno dei suoi tanti visitatori: « Ogni volta che la teoria l'analogia ed il calcolo mi dimostrarono l'impossibilità di trovare quel che cercava, io era sulla via di una nuova scoperta. » (*L'Électricien, 15 février 1882*)

Convien dire che ciò sia vero e che quella frase sia proprio di Edison, altrimenti come si potrebbero spiegare i suoi tanti trionfi? Due anni fa, quando si parlò per la prima volta della luce elettrica prodotta dall'incandescenza di un pezzo di cartone carbonizzato, il mondo scientifico non dissimulò il suo sorrisetto di soddisfazione nel sentire che la prova era fallita, e nell'apprendere che anche l'inventore del fonografo, il grande Edison poteva subire una disfatta.

Due grandi elettricisti, Price in Inghilterra, Du Moncel in Francia, dimostrarono con gran pompa di scienza, che così doveva essere, e che forse la pretesa scoperta si sarebbe concretata fra un centinaio d'anni o giù di lì, e si auguravano di campare quanto bastasse per assistere al trionfo delle idee dello scopritore americano. Guai a loro se quel voto fosse stato esaudito! Ma Price e Du-Moncel non sono due mediocrità che temono degradarsi, confessando il loro errore, sono due robusti ingegni, due uomini coscienziosi che per i primi ridono del giudizio che emisero, ed oggi si schierano fra i più caldi fautori del sistema Edison.

E questo sistema infatti presenta la soluzione completa del grande problema dell'illuminazione elettrica.

Motrice, generatore dell'elettricità, sistemi di distribuzione per le vie e per l'interno degli edificii, apparecchi regolatori e moderatori, apparecchi di sicurezza, contatori dell'elettricità consumata, tutto scaturì dalla mente di quell'uomo straordinario, e tutto fu mirabilmente ideato dal punto di vista della pratica, della semplicità e della solidità.

La luce che emana dalle lampade, prodotta dall'incandescenza di un filetto di carbone di bambou, che brilla nel vuoto entro un vaso di vetro, è stabile, dolce, inoffensiva e sopratutto gradita alla vista perchè non ha quel color bianco lunare che rende antipatico questo genere di luce.

L'esperimento, che per opera del valente ingegnere signor James Shepherd, rappresentante dell'Edison in Italia, si va facendo da più sere nelle sale del Ridotto del nostro massimo teatro, ha convinto i più riottosi della superiorità del sistema Edison.

Il pubblico milanese, che sino ad ora non si mostrò mai molto tenero in fatto di luce elettrica, questa volta dovette smettere il broncio, ammirarla, festeggiarla e lasciar chiaramente comprendere che desidera di vederla prendere stabile dimora almeno nel massimo e nei minori teatri.

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DAILY NEWS, MONDAY, FEBRUARY 27, 1882.

THE ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.

VISIT OF THE DUKE AND DUCHESS OF EDINBURGH.

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With the visit of the Duke and Duchess of Edinburgh to the Crystal Palace, on Saturday evening, the Electrical Exhibition was, though without ceremony, held to be opened. The gradual accumulation of exhibits and preparations for display has necessarily been disclosed to the view of Palace visitors, so that in one sense the exhibition has been open some time, and its attractions have been generally described in these columns. On the other hand, the exhibition had even on Saturday hardly reached the height of its splendour. Preparations for more brilliant lighting in parts of the Palace were noticeable. This week, therefore, more may be seen than was visible to the Duke and Duchess on Saturday evening. For example, in the Alhambra Court the rich Oriental colour decoration brought out so charmingly in the effulgence of three or four score of Lane-Fox lamps is destined shortly to receive still more brilliant illumination. The outlines of the Moorish architecture are to be picked out with studs of light On these the eye may rest without being dazzled, for the lamps are opalised. Again, the display of Swan lamps in the Picture Gallery must surely be of great interest to those who take pride in the reflection that the subdivision difficulty has had its English as well as American conquerors, and sympathise with the success which has in Mr. Swan's case, rewarded the patient labour of so many years. Unfortunately, the preparation of the Picture Gallery for the Royal visitors on Saturday was a few minutes too late. The emulation of competitors for public approval will doubtless lead to the introduction from time to time of new effects. In a week or so we are promised a new system of cells for the storage of electricity, the capacities of which will bring appreciably nearer the day to which Sir W. Thomson first encouraged us to look forward, when we may go to Niagara Falls and other natural sources of at present unutilised power; convert that power as we are now converting steam power at the Crystal Palace into currents of electricity, bottle up these currents in portable cells and take them away, to add to the happiness of mankind, and to do its work in a cheaper, cleaner, quieter, and in every way healthier manner than that of the present agents of our boasted civilization.

In the meantime, as the Duke and Duchess of Edinburgh found on Saturday night, there is a good deal more to see at the Palace than can be properly seen in one brief visit. Their Royal Highnesses arrived at ten minutes past six in the evening. With them were the Prince of Waldeck and Pyrmont, the Earl and Countess of Dalhousie, Lady E. Osborne, Col. J. Colville, and Captain Clarke. They were received at the Palace Station by Mr. McGeorge, Major Dickson, and Major Flood Page, respectively the Chairman, Deputy-Chairman of Directors, and Manager to the Crystal Palace Company. Conducted first across the Transept, they had an opportunity of seeing the general effect of the numerous competing arc lights, suspended like so many full moons in mid-air between the northern and southern extremities of the Palace. Amidst their light the gas-jets marking the lines in the ceiling whence springs the dome lost their brilliancy, and as if envious of an admiration once theirs but now transferred elsewhere assumed the colour which in the village vocabulary denotes the dejection of the forsaken. The Jablochkoff light of the Compagnie Générale d'Electricité was in possession of the first avenue traversed by the visitors. Passing southwards past the great stage, they entered the Concert Room, where was seen one, but by no means the principal, display of the Edison electric lighting system. The remarkably steady incandescent lamps arranged on the ladder principle hung in festoons all round the galleries and in front of the organ. Above the organist's seat the name "Edison" shone forth in letters made up of the bright lamps. From the ceiling was suspended in the centre a crystal chandelier sparkling with the Edison light. Pendant lights also illuminate the platform, while the space under the galleries was illuminated by pendants of lights, springing like petals from the interior of flowers, of variously coloured glass. These were specially observed by the Duke and Duchess. Beyond the concert room was placed a huge chandelier of brass work bearing Swan lights. In the Eastern gallery an organ performance, a selection from "Athalie," was heard through telephone; and downstairs, again, a capital view of the general lighting of the Palace was obtained from under the great clock, whence, beginning with Siemens' various beautiful lamps, could be seen the lights of eleven different systems. In the West Gallery, whilst inquiry was being made whether the Picture Gallery was yet ready for inspection, a naked arc light, shown by Messrs. Hawkes and Co., of Westminster, was examined with some interest, since the mechanism for regulating the carbons was open to view. The arc is established in this lamp by the passage of the current operating upon two magnets, and is controlled and sustained at its proper dimensions by a regulator which allows the carbons properly to approach each other at a slow rate. On a second descent to the nave Rowatt and Fyfe's display in the Pompeian House was noticed in passing on towards the great crystal fountain, where the illumination of the basin by incandescent lamps sunk in the water was remarked as an interesting special application of this form of light. The six Siemens' differential lamps arranged on an immense steel chandelier, and a number of Swan lamps, also maintained by Siemens' machinery, were conspicuous in the path of the Royal visitors, who were now making for the western corridor, where the Faure accumulator is exhibited and a portion of the machinery for the different lights is seen in motion. On the way Mr. Kelway's electric log and its applications to various nautical purposes was the subject of minute inquiry by the Duke. The Chinese Court, lit up by the Crompton lights, was too attractive not to detain the party a little while, but it was in the Entertainment Court that they lingered longest.

The Edison display in the Entertainment Court was in point of taste perfect, and as an illustration of the domestic uses of electricity complete. The central attraction of this tastefully arranged display is an enormous gilt chandelier of elaborate floral design, into which Messrs. Verity and Son have evidently put their best work as art metal-workers. Conspicuous in the metal work is the repetition of that blossom of an æsthetic age, the sun-flower, yet it does not obtrude itself as its posturing admirers are reputed to do, but rather contents itself with the position of a modest foil to other flowers, which, being severally endowed with a corolla of tinted glass, have the distinction of radiating the light. At the will of the lighter 120 variously-hued flowers blossom on this golden tree, growing downward from the ceiling. You open a little secret door in the panelling of your wall and there discover a handle ready to be turned.

screw it one-third of a turn to the right and you have a third of your lights turned on; one more touch and a third more of your flowers are blooming and imparting fresh light; complete the turn of the handle and the full brilliance of your chandelier is displayed. This is the application of the Edison light to the assembly-room.' In other parts of the room neat lamps, neatly arranged, exemplify the use of the light in parlour or library and particularly its admirable illumination of the billiard table. The devices for the boudoir are particularly striking. For example, in the interior of wall mirrors with bevelled glass frames is placed an incandescent lamp, and light is thus thrown on to the surface of the mirror from the bevelled sides in a manner which should occasion the despair of manufacturers of mirror candelabra. There is in this device also the suggestion of a mode of illuminating works of art. An extremely neat electrical cigar or pipe lighting apparatus much amused the Duke of Edinburgh and his friends. In front of a small porcelain column are arranged vessels containing pipe-lighters of metal immersed in an inflammable liquid. On the withdrawal of any of these from its place an electric current which has hitherto presumably found a short cut to its destination through the end of the pipe-lighter has to follow a new route which leads it through the interior of the porcelain column and out to a globe on the top, where it meets with a small spiral of wire. By the time the smoker has got the pipe-lighter fairly out of its socket this little spiral is approaching white heat, and you have but to apply the soaked pipe-lighter to obtain the needed light. Replace your lighter in its socket, and the light almost instantaneously disappears. This simple but ingenious application of the ele[illegible] current to the wants of the smoker may be commended to the earnest attention of the Anti-Tobacco Society, for who knows whether smokers may not be demanding its adaptation for their convenience to every lamp-post through which the current passes, as an immense improvement on the antiquated *pro bono publico* lantern of accommodating tobacconists? The manager of the Edison system in this country, Mr. E. H. Johnson, who has every reason to be gratified at the appreciation of his excellent work manifested by his distinguished visitors, showed them, in addition to the various things already mentioned, the mains by which under this system the wires would be carried through the streets, and explained the manner in which the houses would be supplied and security afforded against danger. The experiment of breaking an incandescent lamp was made to show, as was some time ago proved at the Savoy Theatre, that the accidental breaking of an incandescent lamp is attended with no other inconvenience than the extinction of the light till another lamp is found. The Royal visitors laughed over the performance of Mr. Edison's speaking phonograph. The words "Welcome to their Royal Highnesses the Duke and Duchess of Edinburgh," were spoken into the phonograph by Mr. Johnson. When the speaking trumpet was put on the instrument, and the needle caused to trace the marks imprinted on the revolving tinfoil by Mr. Johnson's voice, the words came clearly forth again. The Duchess carried away, at Mr. Johnson's request, the tinfoil on which the vibrations of the voice had been thus accurately recorded.

In the North Nave the British Electric Light Company's arc light came under notice, and in one of the adjoining courts admiration was duly bestowed upon a remarkably pretty combination of their incandescent lamps and the ornamental glass work of Messrs. Powell and Sons, of the Whitefriars Glass Works. In the North Nave also the Electric Light and Power Generator Company exhibit a hundred maxim incandescent lamps, each of 50-candle power, on a magnificent cut crystal candelabrum, more than 20 feet high. This is of floriated Gothic design, and is the chief of many specimens of English crystal work much admired in connection with this company's exhibition. The manufacturers are Messrs. J. Defries and Son, of Houndsditch, who we find have adopted the word "electrolier" as a substitute for chandelier in the present age of electricity.

Finally, the distinguished visitors entered the Tropical Court, the lighting of which is given to the Anglo-American Brush Corporation, who appear to have brought to admirable perfection not only the arc-light, in which they won early triumphs, but also the incandescent light as supplied to the Lane-Fox lamps. The Alhambra Court, already illuminated by sixty of these lamps, arranged on a splendid crystal "electrolier," as Messrs. Defries call it, and by a dozen or two more suspended in ornamental glass baskets, is, as has been already stated, to be more brilliantly lighted by this corporation. After the Duke of Edinburgh had witnessed their machinery, the rapid revolution of which produced a disturbance of the atmosphere calculated to make his Royal Highness think himself at sea with a fresh breeze blowing, this corporation's enormous light of 150,000-candle power was turned on, with the result apparently of literally turning the already-forgotten night into broad day. The Duke afterwards went to the grounds to witness the model experiments in ship-lifting by the camels which have been before described in the *Daily News*. Light with which to make the experiment was supplied by Messrs. Swan and Siemens, and full explanations were given by Mr. Latimer Clark. The Duke and Duchess, and the party accompanying them, afterwards dined at the Palace with the directors.

The exhibition was largely attended by the general public on Saturday evening, but the Royal visitors were able more freely to make their way from place to place than might have been deemed possible owing to the admirable arrangements of Police-superintendent Butt, and the energetic assistance he received from Reserve-Inspector Giles, of the P division, and the other members of the force at his command.

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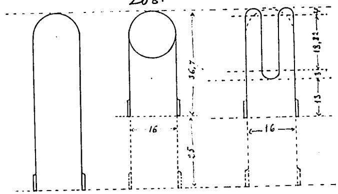


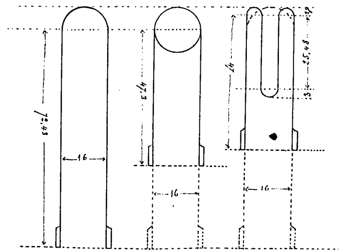
Charbon A

Charbon A roulé en spirale (1 spire)

Charbon A forme M.

Grandeur d'exécution

Cotes en millimètres.



Charbon A

avant la Carbonisation.

THE TIMES, MONDAY, FEBRUARY 27, 1882.

THE ~~INTERNATIONAL~~ ELECTRICAL EXHIBITION.

2082

The exhibition of electrical machinery and apparatus at the Crystal Palace has so far advanced as regards the illumination of the building that for all practical purposes it may be considered as complete, although in some instances matters of detail have to be finally adjusted and several of the stands have yet to be occupied. However, sufficient has been done to justify a visit by their Royal Highnesses the Duke and Duchess of Edinburgh, which took place on Saturday. The Duke and Duchess reached the Palace shortly after 6 o'clock and were received by the chairman of the Crystal Palace Company, Mr. M'George, the deputy-chairman, Major A. Dickson, and other directors, with Major Flood Page, the manager, and by them were conducted over the exhibition. Their Royal Highnesses and suite entered from the High Level railway station, and proceeded first to the north nave, which they crossed to the concert-room, beautifully illuminated by the Edison incandescent light. They then passed through the adjoining furniture court and up to the eastern gallery, where the telephone room was a source of much interest, the organ performance in the concert-room being attentively listened to. Quitting the eastern gallery, the south end of the Palace was traversed, where the Siemens light was much admired. The Royal visitors then ascended to the western gallery, where they inspected the Hawkes electric light. Descending again to the south nave, some time was spent in examining the various systems and electrical appliances in the west corridor. The Chinese Court, with the Crompton light, was then visited, the light, and afterwards the machinery, being explained by Mr. Crompton. The entertainment court, which was magnificently illuminated by the Edison light, was a great attraction, Mr. Edison's various inventions, including the phonograph, being explained and worked by Mr. Johnson. From the Edison room the visitors passed through the various courts on the western side of the north nave and through the nave itself, inspecting the various systems of electric lighting, presently to be described. The tropical department, which was brilliantly lighted by Brush arc lights and Lane-Fox incandescent lamps, was next inspected, the visitors afterwards proceeding through the courts on the eastern side of the north nave. The tour of the Palace having been accomplished, his Royal Highness proceeded to the diving pavilion, where Mr. Latimer Clark explained his system of raising sunken vessels by means of gripping camels. After the inspection and distinguished visitors were entertained at dinner by the chairman and directors of the Crystal Palace Company.

We have already in a previous notice described the engines and machines by which the various systems of electric lighting are now being carried out. Since that date, however (the 9th of January last), several alterations and additions have occurred. We will, therefore, describe in general terms the lighting arrangements as they now exist. Commencing at the north end of the Palace, we find the tropical department and the Byzantine and Alhambra Courts as well as the Aquarium lighted by the Anglo-American Brush Electric Light Corporation. The Byzantine Court is illuminated by means of the Brush arc light, while the tropical department and the Alhambra Court each have a handsome central chandelier with Lane-Fox incandescent lamps. Eventually the arches of the Alhambra Court will be lined with Lane-Fox lamps, which will greatly enhance the beauty of the scene. The aquarium is lighted by Lane-Fox lamps, while high up in the roof of the tropical department is a Brush arc light estimated to be of 150,000-candle power, and using carbons 2in. in diameter. The next light is that of the Electric Light and Power Generator Company, who use arc lamps supplied with currents from two Weston machines and who light up a portion of the north end of the nave and the Mediæval and Roman Courts. This company, who were the first to light up, as mentioned in our previous notice, also have a magnificent glass candelabrum fitted with 12 Maxim incandescent lamps. We next come to the display of Mr. G. G. André, who is lighting a portion of the nave, the Grecian Court, and the South Court with his arc lamps. He is also about to light the Rennaissance Court with his incandescent lamps. Mr. André is also arranging for 16 arc lights on the garden terrace, illustrating his system of street lighting, in which he adopts Sugg's lantern as used in the gas lamps in Parliament-street and Whitehall.

The next example of electric-lighting is that of the British Electric Light Company, who illuminate a part of the nave, the Egyptian Court, and the court opposite to it with the Brockie arc lamp and their own incandescent lamp. The Compagnie Générale d'Electricité light up the opera theatre, a corridor adjoining it, and the gallery over it by means of the Jablochkoff candle. They also light the station of the London and Brighton Railway, their engine and machine house for that installation being placed near the station. We next come to the centre transept of the Palace, which we find illuminated by the Crompton arc light, the current generator being the Bürgin dynamo machine. Messrs. Rowatt and Fyfe light the Handel orchestra and the Pompeian Court with the Joel and the Pilsen electric lamps. The concert-room, the entertainment court opposite, and the industrial avenue are devoted to the Edison light, which is there to be seen in all its beautiful variety of forms. Besides the light, examples of Mr. Edison's numerous electrical inventions are to be found in the entertainment court, including the phonograph, the telephone, the electric pen, and electric telegraph apparatus. The corridor leading to the London, Chatham, and Dover Railway Station, and the booking-office are also illuminated by the Edison light. Messrs. Strode and Co. light a portion of the south nave with four Mackenzie arc lamps. They also exhibit the Lane-Fox incandescent lamp. The adjoining portion of the nave is lighted by Messrs. Gravier with their arc light. They also illuminate the Scientific court by the same means. Mr. J. G. Lorrain is lighting a portion of the south nave, the western gallery, and the Chinese court with Gérard's electric lamps. An automatic cut-off is used, where a large number of lamps are placed on one circuit, so that, should an accident occur to one lamp, the others are not affected. Swan's Electric Light Company are lighting the French court, a part of the picture gallery, and the saloon dining room with the Swan incandescent lamps.

The whole of the remaining portion of the south nave is illuminated by Messrs. Siemens, Brothers, and Co., who have a Siemens hanging pendulum lamp over the crystal fountain. They also have six Siemens differential lamps in a handsome chandelier, and two similar lamps on iron poles as used in street lighting. The current to the 60 Swan lamps in the saloon dining-room is also supplied by Messrs. Siemens from one of their dynamo machines, which are driven by engines by Messrs. J. and H. Gwynne, of Hammersmith. There are four of these engines, two being vertical and two horizontal, driving Siemens dynamo machines of various powers. Messrs. G. Hawkes and Co. are lighting the western gallery under the gymnasium with their arc light. The Technological museum, the Costume court, and the long stretch of corridors and staircases leading from the south end of the Palace to the Low Level Railway Station are lighted by the Hammond Electric Light and Power Supply Company, who use the Brush light for that purpose. Such, then, is the electrical machinery and apparatus by which a splendid flood of electrical light is diffused throughout the body and courts of the Palace, and it was greatly admired by the Royal visitors on Saturday.

The next points of interest are the various stands on the main floor of the Palace, at which a variety of electric telegraph and other apparatus is exhibited. Chief among these is the stand of the Postal Telegraph Department, where may be seen a fine collection, comprising all the modern electrical apparatus as used by the Post Office. There is also an interesting collection of apparatus marking the history and development of electric telegraphy, as well as a variety of apparatus connected with the system of pneumatic tubes in use by this Department. The War Office is represented by a collection of apparatus used in submarine mining and also of that used in field and mountain telegraphy. The Telegraph Construction and Maintenance Company exhibit a case of specimens of submarine telegraph cables illustrating the progress and development of submarine telegraphy to the present time. They also show a proposed system for establishing communication between lightships and the shore by means of specially protected submarine telegraph cables. The Eastern Telegraph Company show a collection of electrical apparatus for submarine telegraphy, also specimens of telegraphic cables which have been recovered. The Submarine Telegraph Company show specimens of their cables as laid down and worked by them, and of other cables possessing historical or scientific interest. The Exchange Telegraph Company exhibit a variety of type-printing instruments and electrical signalling apparatus. The various telephone companies exhibit their instruments, and arrangements have been made by which conversations are carried on between persons situated at various points in the Palace. Several of the railway companies have stands, at which they exhibit the electric apparatus connected with the telegraphic systems on their lines. There are also stands where the manufacturers of electrical apparatus for signalling, lighting, and other purposes exhibit their productions, the whole forming an extensive and highly interesting display. In the galleries are also a number of stands where electrical apparatus of various kinds are exhibited, a notice of which we must, however, defer for the present.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, FEBRUARY 28, 1882.

GAS ENGINEERS AT THE ELECTRICAL EXHIBITION.

The most elaborately prepared laws are frequently found to be incomplete when complications of a more or less unusual nature arise. The rules of The Gas Institute, for example, have been prepared with great skill and infinite pains on the part of the Legislative Committee, and it might have been supposed that they contain ample provision for every eventuality. It has happened, however, that these regulations, being based on the assumption that the Institute should hold a single session every year, do not contemplate the holding of special or extraordinary meetings. Since the British Association of Gas Managers was founded, there has not been any occasion for a meeting of the latter class, and it was not to be expected that this unbroken series of regular annual gatherings would be disturbed in the first year of the existence of The Gas Institute. This circumstance has now occurred, and for the first time the members of the Institute are being called upon to meet at an unusual time, and for an extraordinary purpose. Fortunately, what cannot be done by law can sometimes be easily effected by good will; and in this case the defect of the rules has been supplied by the spontaneous action of the President, who, with the advice and active concurrence of the Council, has taken the graceful step of dismissing the formal difficulty by inviting the members personally in his own name.

If the holding of a special meeting by the members of The Gas Institute is an unprecedented event, the purpose of their assemblage is no less extraordinary. A grand attack has been made by electricians, during the past four years, upon the position of gas as the common illuminant of urban populations. Gas supply has been practically in a state of siege during this time, and now it has seemed fit to the assailing forces to hold a grand review before all men. Hence it is natural and praiseworthy that the representatives of the gas interest in this country should desire to see what manner of competitors they have to meet. It would have been most regrettable if The Gas Institute had let slip the opportunity which is now presented of affording, to those of its members whose duty and inclination lead them to Sydenham, the support of mutual association in making their inquiries. It may be hoped that the spirit of the President's invitation will be generally appreciated by those friends and supporters of the gas industry who are not actually members of the Institute, yet, as gas directors or members of local authorities, are not less concerned in the possible competition of electric lighting with gas. The fame of the Electrical Exhibition is being assiduously spread throughout the country, and as it will be of decided advantage that those local authorities who may have occasion to speak of it at home should do so upon knowledge derived from personal inspection rather than upon hearsay, it will be desirable also that as many as possible should view the exhibition together. An electric lighting exhibition is seldom alike two days in succession, and it may save subsequent misunderstandings if a number of observers, perhaps of different bias, examine the "chameleon" at the same time.

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Without seeking to point a moral to the inspection which takes place at the Crystal Palace to-day, and in respect of which there may possibly be some divergent opinions formed by the members of the Institute and their friends, there is one very prominent feature of the show which can scarcely be overlooked. We do not speak so much in regard to the arc lamps, although the same remark applies to this class, as of the various descriptions of incandescent lamps, when we say that gas engineers may take a lesson from the treatment of their lamps by the electrical engineers. These lamps attract a great deal of attention, and excite much admiration from the general public, for two reasons. In the first place, the quality of the light is excellent, and its steadiness equally remarkable; and, secondly, the appliances whereby it is shown to be adapted to various uses are strikingly beautiful and appropriate to their purpose. The early development of gas lighting, like that of railway travelling, took place at a time when artistic and rational methods of treating new appliances intended to supplant old things were unheard of. Railway carriages were perforce made like stage coaches, with the lamentable results from which the present generation of travellers still suffers; and gas-fittings were made to imitate candles and oil lamps, and have continued to do so down to the present day. Gas engineers did not, even if they could, instruct gas-fittings manufacturers in the principles by which the best effect could be produced from the gas burnt; and the manufacturers and brassworkers of the time were lamentably deficient in the power of originating true and artistic designs. Thus, partly from the carelessness of individuals and partly from the spirit of the age, gas-fittings became the inefficient and meaningless things which, but for some modern efforts at reform, they would still hopelessly remain. Incandescent electric lighting has dawned upon a widely different period. The progress of art is exuberant even to rankness in some respects; but under all this modern extravagance, there is a sense of the necessity of bringing out the fitness of things, to which the handicraftsmen of the past generation were strangers. Hence it is that the incandescent lamp fittings at the Crystal Palace are so effective. Electricians and brassworkers have combined their energies for securing a common object, and the result is equally original and appropriate. We shall not find Mr. Edison attempting to make his luminous threads imitate candles, lamps, or gas-burners; they are treated as they deserve, on their own merits, and they amply repay for the consideration. Therefore this exhibition at least shows that the details of standards and pendants are not held to be beneath the observant care of the engineers who produce the light. Gas engineers must take a similar educated interest in all that appertains to gas lighting, in order that the special economical advantages of this system, on which they are always so ready to dilate, shall not be missed through the ignorance and carelessness of gas-fitters and consumers.

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THE GOVERNMENT AND THE ELECTRIC LIGHTING BILLS.

ALL fears that the various Electric Lighting Bills now before Parliament might not receive sufficient consideration have now been dispelled by the announcement of the President of the Board of Trade on Monday last week. The promised action of Mr. Chamberlain goes farther than might have been expected, since he proposes to introduce a General Bill to define the principles of legislation on the subject of electric lighting. Whether the time is ripe for such a measure may be matter for debate; but it is desirable, if private legislation of a novel character is to go on this session, that it should be made uniform from the beginning. It is also proposed to refer the Government Bill and all Private Bills dealing with the same subject to a specially constituted Committee, so that the question shall be dispassionately and authoritatively investigated before any further steps are taken. The immediate effect of this proceeding will be to delay the passage of the Bills until an indefinite period late in the year, if even there is to be anything settled this session. The wisdom of Mr. William Livesey's warning to Gas Companies is therefore amply justified. He wrote in our columns some time since that the insertion of electric clauses in Gas Bills would certainly delay to an inconvenient extent the passage of such measures, and was consequently to be deprecated apart from all other considerations. It is now evident that such clauses must be struck out of all Gas Companies' Bills, unless the promoters are utterly regardless of cost, time, and danger in their endeavour to obtain this very doubtful privilege. It is highly probable that the promoters of the more especially speculative Bills entirely devoted to electric lighting will undergo a very severe discipline when their pretensions are examined in committee, and Gas Companies may well stand aside and let them get over their difficulties in the best way they can.

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AN ELECTRICIAN'S VIEWS ON ELECTRIC LIGHTING.*

Mr. Killingworth ~~Hedges' practical~~ knowledge of electric lighting should peculiarly fit him for writing a small book on the subject, intended for general readers; although his well-known personal and professional interest in a part of the matter on which he treats would naturally lead us to refuse him the position of an unbiassed man of science. Mr. Hedges' book has now arrived at the dignity of a third edition, the first having been published in 1878. In his preface to the third edition the author refers to the period of four years which has elapsed since his work first appeared, and states his conviction that electric lighting having in this time "passed out of the hands of the experimentalists, has taken a recognized position as the illuminant of the nineteenth century." In the first edition Mr. Hedges apologized for saying little as to the cost of different systems of electric lighting; and in the present edition this branch of the subject will be found to occupy a chapter to itself. In regard to incandescent lighting, which the author elsewhere acknowledges to be the system to which public expectation is principally directed, he candidly states that if it "becomes the success its advocates believe it will, it is still doubtful whether it will ever be sufficiently economical to warrant its superseding gas in all cases;" and that, "although Mr. Edison says to the contrary, it is a question whether heat for cooking purposes could be practically produced at all; and even if it were, the cost would be enormous." Mr. Hedges says, however, that arc lighting should be one-third cheaper than gas; but as he appears to rate gas at about one-third of its actual luminous value, when employed in the powerful flames necessary to compete with an arc light, the comparison is not so advantageous to electricity after all. The author gives tables of the cost of some of the latest installations of arc lighting, by which he seeks to prove that when used in large centres, electricity is cheaper than gas. He confesses again that the case is reversed with incandescent lighting; and, as usual with gentlemen of his way of thinking, he begs the whole question of distribution by asserting, without a shadow of evidence, that this will be altered when "the current is generated at a central works, and supplied like its older rival." With regard to street lighting, Mr. Hedges confesses that gas must still be employed for the narrow thoroughfares, but asserts that the electric lighting of the City is a success "except in the material one of cost." In respect of lighthouse use, the author cites the opinion of Dr. Barnard, of New York, who states that the power of an electric arc lamp is reduced by fog to that of an oil lamp, which it ordinarily exceeds in the proportion of 10 to 1. Mr. Hedges kindly devotes a few paragraphs to the purpose of reassuring timid gas shareholders as to the continued value of their property. He acknowledges that the present position of the gas industry in this country is due to the continued exercise for 70 years of the most praiseworthy enterprise, and believes that the results of this enterprise will remain valuable. This little work is, on the whole, a well-compiled account of facts, accompanied by a fair and interesting commentary, and is calculated to impart much valuable information to unprofessional readers.

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THE DAILY TELEGRAPH, THURSDAY, MARCH 2, 1882.

THE FAURE ELECTRIC ACCUMULATOR COMPANY (Limited)—Incorporated under the Companies Acts, 1862 to 1880.—Capital, £1,000,000, in 80,000 ordinary shares of £10 each, and 200,000 deferred shares of £1 each.—FIRST ISSUE of £500,000, in 40,000 ordinary shares of £10 each, and 100,000 deferred shares of £1 each. Subscriptions are invited for the 40,000 ordinary shares of this issue, entitled to a cumulative preferential dividend of 10 per cent. (with the right to further participation in profits, as stated hereafter). Payable as follows: £1 on application, £1 on allotment. The balance to be called up as required in amounts not exceeding £1, subject to 28 days' notice.

DIRECTORS.

Sir ARTHUR OTWAY, Bart., M.P., Director of the London, Brighton, and South Coast Railway Company, Chairman.
Sir Charles Clifford, Chairman of the New Zealand Trust and Loan Company (Limited).
C. Seymour Grenfell, Esq. (Messrs. Pascoe, Grenfell, and Sons), 27, Upper Thames-street, E.C.
Sam Mendel, Esq., Director of the Alliance Bank (Limited).
Harvey Ranking, Esq. (Messrs. John Ranking and Co.), 11, St. Helen's-place, E.C.
Consulting Electrical Engineers—Professor W. E. Ayrton, F.R.S., and M. Camille Alphonse Faure.
Electrical Engineer—Radcliffe Ward, Esq.
Bankers—The London and County Banking Company (Limited), 21, Lombard street, E.C.
Solicitors—Messrs. Freshfields and Williams, 5, Bank-buildings, E.C.
Brokers—Messrs. Brunton, Bourke, and Co., 18, Finch-lane, E.C.
Auditors—Messrs. Turquand, Youngs, and Co., 41, Coleman-street, E.C.
Secretary (pro tem.)—Thomas E. Youle, Esq.
Temporary Offices—St. Stephen's chambers, Telegraph-street, Moorgate-street, E.C.

PROSPECTUS.

This company has been established to acquire all the patents and processes now owned by the "Société la Force et la Lumière" for the United Kingdom of Great Britain and Ireland, the Channel Islands and the Isle of Man, under a contract dated the 2[illegible]th day of March, 1881, and made between Camille Alphonse Faure and the "Société Anonyme la Force et la Lumière," or which may hereafter be obtained by that society. The chief of these patents is Faure's Accumulator, or secondary battery, and the nature of the business which the company proposes to carry on is fully indicated by the memorandum of association, a copy of which is printed in the fold of this prospectus.

By means of Faure's accumulators, electric energy can be stored and retained, to be redistributed as required for the production of light and motive power. The accumulator, indeed, bears the same relation to electric energy as the cistern to water and the gasometer to gas. The light thus obtained is perfectly steady, and without glare, and its capability of subdivision and storage has now been fully established. For successful and economical application to the lighting of mines, houses, and railway trains, Faure's accumulator offers the exceptional advantage that, in the event of temporary accident to or stoppage of the electric motors, there is no danger of any extinction of the light.

One of the sources from which it is confidently anticipated that this company will derive a considerable revenue is the lighting of railway carriages. To light them economically, as well as effectually by electricity, accumulators are absolutely necessary, as without accumulators the light would vary in intensity in proportion to the speed, and would be extinguished on the stoppage of the train. A brighter light can be obtained by means of Faure's accumulators than at present found in railway carriages, and at a cost, including wear and tear and renewals of incandescent lamps, &c., considerably less. The light thus obtained is indeed vastly superior, as may be seen [illegible] on inspection of the Pullman Car Train which has been running on the Brighton line during the last three months, lighted by electricity supplied by Faure's accumulators.

It is difficult to enumerate in a prospectus the ends to which Faure's accumulator may eventually be applied, or to fix limits to its usefulness, but one of the most important purposes to which it may be immediately and advantageously applied is as a motive power for tramcars. According to the published accounts of the tramway companies it may be deduced that the cost of working tramcars by electricity, in conjunction with Faure's accumulators, would show a large margin of saving over the present system, after making due allowance for all outgoings. It is anticipated that the profits from this source alone will be considerable.

The motive power may further be at once equally advantageously employed in the working of fire engines, hoists, cranes, sewing machines, lathes, &c.

In the opinion of men of science Faure's invention marks a new departure in the practical and economic application of electricity to industrial and domestic purposes, and will necessarily command general adoption.

Sir William Thomson thus expressed himself about it in a letter to the "Times:" "The subject is one in which I feel intensely interested, seeing in it a realisation of the most ardently and unceasingly felt scientific aspiration of my life."

To an inquiry addressed to him subsequent to the opening of the Paris Electrical Exhibition, in the following terms: "Since the Faure Battery has been known and described, has there, to your knowledge, been any other battery discovered which in any way approaches or can be held to be able to compete with it?" Sir William Thomson replied: "No; I have heard of several other secondary batteries, but none of which approaches to the practical value of Faure's."

It is needless to say that the commercial field for an invention of such value is a wide one; so convinced, indeed, are the vendors that the shares of this company will pay dividends at a high rate, that they have agreed to take four-fifths of their nominal purchase money in deferred shares.

The price to be paid by this company for the purchase of Mr. Faure's and all other patents and processes now owned or which may be obtained by the Société la Force et la Lumière for the United Kingdom of Great Britain and Ireland, the Channel Islands, and the Isle of Man, is the sum of £25,000 in cash and 100,000 deferred shares of £1 each fully paid, and a like proportion of deferred shares in any further issue of capital which may be made by this company.

The net profits in each year (subject to the provisions of the articles of association for the establishment of a reserve fund, and for the remuneration of the directors) are to be appropriated in the following order:—

First—To a cumulative preferential dividend of 10 per cent. on amounts paid up on ordinary shares.

Secondly—To a cumulative dividend of 10 per cent. on like proportions of deferred shares (such shares for purposes of dividends only being treated as having the same proportion paid up thereon as the ordinary shares).

And Thirdly—One-half of surplus profits to dividends on ordinary and deferred shares, according to the amounts paid up or treated as paid up as above, and the other half to dividend on deferred shares only.

The vendors undertake to pay all the preliminary and other expenses of the company, including advertising, printing, and legal charges, up to and including the allotment of shares.

An agreement has been entered into, dated the 15th day of February, 1882, between John Henry Johnson, of No. 47, Lincoln's Inn-fields, in the county of Middlesex, gentleman, of the first part, Camille Alphonse Faure, of No. 108, Boulevard Rochechouart, in the city of Paris, of the second part, La Force et la Lumière a Société Anonyme, formed according to the law of Belgium, of the third part, and John Wiseman, of No. 12, Tresillian-road, New-cross, in the county of Kent, gentleman, of the fourth part.

The above agreement, together with the memorandum and articles of association of the company, can be inspected at the offices of the solicitors of the company.

If no allotment be made the deposit will be returned forthwith, without deduction. Should the shares allotted to any applicant be less than the number applied for, the surplus paid on application will be credited in reduction of the amount payable on allotment.

Prospectuses and forms of application for shares can be obtained at the offices of the company, and from the bankers and brokers.

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LA LOMBARDIA 12 Marzo 1882 N. 70

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L'illuminazione elettrica Edison nel ridotto della Scala continua a destar l'ammirazione di tutti. A dare poi un saggio di questa illuminazione applicata alle strade, l'egregio ing. James Shepherd sostituì al primo lampione a gas di via Filodrammatici (casa N. 2), una lampada Edison.

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The Daily Telegraph. March 7/82

THE NEW PULLMAN LIMITED EXPRESS (Lighted by Electricity) now runs between VICTORIA and BRIGHTON as under:

From Victoria, Weekdays at 10.0 a.m. and 3.50 p.m.

From Brighton, Weekdays, at 1.20 p.m. and 5.45 p.m.

This New Train, which has been specially constructed and elegantly fitted up by the Pullman Car Company for the service between Victoria and Brighton, consists of four Pullman day cars, named respectively Maud, Victoria, Louise, and Beatrice.

Each car is over 55ft. in length, making the total length of the train over 233 ft.

The car Beatrice (drawing room) contains also a ladies' boudoir and dressing room.

The car Louise (parlour) contains also a separate compartment for a private party.

The car Victoria is provided with a buffet for tea, coffee, and other light refreshments; a newspaper counter, together with a clock, barometer, &c., are also furnished to this car.

The car Maud is appropriated for smoking.

Lavatories are provided in each car.

A separate compartment available for servants is also provided in one of the cars.

The staff attached to this train consist of a chief conductor, assistant conductor, a page boy, and two guards.

There is electrical communication between the several cars and the conductors, whose head quarters are in car Victoria.

A passenger travelling in any one of the cars can therefore call the attention of the conductor by pressing one of the small electric discs, which are conveniently placed in each of the cars.

The whole train is lighted by electricity, the system being that of Edison's incandescent lamps in connection with Faure's system of accumulators.

The cars are heated to a temperature of about 60 degrees by Baker's patent car heater.

There is a covered gangway communication between each car, thereby enabling the conductors to pass from car to car and throughout the whole length of the train.

The entire train, including the engine, is fitted with the Westinghouse automatic brake.

The following other trains between Victoria and Brighton have also Pullman cars attached:

From Victoria, Weekdays, 1.50 p.m. and 4.30 p.m.; Sundays, 10.45 a.m.

From Brighton, Weekdays, 9.45 a.m. and 11.0 a.m.; Sundays, 8.30 p.m. By order. J. P. KNIGHT, General Manager.

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ELECTRICITY AT THE CRYSTAL PALACE

II.—*Edison's Electric Light*

THE centre of attraction at the exhibition of electricity in the Crystal Palace, formally opened on Saturday by the Duke and Duchess of Edinburgh, will unquestionably be the show of Mr. Edison. His electric light in the Entertainment Court and the Concert Room is by far the finest ever yet made, and is of itself a spectacle to be remembered. No expense has been spared to demonstrate the power and beauty of his incandescent lamps, and the divisibility of the current to meet the wants of domestic lighting; while Messrs. Verity and Sons have seized the occasion to illustrate their skill and show how eminently adapted the electric light is for ornamental purposes. The heated filament of carbon inclosed in a vacuous bulb of glass is well fitted for all kinds of domestic illumination by reason of its pure and absolutely steady glow, its healthiness and freedom from noxious fumes, and its comparative coolness. But in addition to its superiority over gas, oil, and candles in these respects, the Edison exhibit also proves in the most striking manner its superiority as a decorative light, and its unrivalled capacities for enhancing the artistic pleasures of our homes. Besides giving off no deleterious gases to tarnish gilding or dim the most delicate colours, the incandescent lamp lends itself to the designer's fancies in a way which no other illuminant can; and we may expect something like a revolution in household decoration by its introduction, as well as a new development of the brass-worker and the glass-blower's arts.

Before considering the apparatus employed by Mr. Edison at the Crystal Palace for the production and distribution of the light, we shall briefly describe the results. To begin with the Entertainment Court, which is in reality a small theatre, the principal object of interest is a magnificent chandelier suspended from the middle of the ceiling. This beautiful object is in itself a work of art, and sustains ninety-nine incandescent lamps. It is conical in general shape, and is about fifteen feet in height by ten feet in diameter at the lower end; while its weight is half a ton. In device it represents a tapering bouquet of flowers rising out of a golden basket. The stem of each flower springs from a circular brass plate within the basket, and bends over towards the spectator, presenting to him its calyx of coloured glass, in which is fixed an incandescent lamp. The foliage is all of hammered brass, richly gilt, and here and there is mingled with the sun-flower or tiger-lily, and some rambling sprays of fern. The corollas of the flowers containing the lamps, and acting as their shades, are in the form of heaths and harebells, made of glass, and tinted with a variety of colours—pearl, white, ruby, clear olive, and clouded blue. Each lamp projects from the heart of the flower like an enlarged pistil, and throws its light outwards and downwards into the room below. The lights are controlled in three sections by turncocks, like gas, and thus a graduated effect can be obtained, or all the lights may be put on or off at will.

On each side of the stage, which is furnished with a row of twenty-four footlights, there is a pretty candelabra[1] mounted on a short marble column, and representing a rose-bush springing from a golden urn. The stem of the bush is entwined with China roses, and crowned with five upright lamps or candles, like the fruit of the tree. On the left of the stage is hung an exquisite little chandelier or lustre of Venetian glass, which, though far less imposing than its gaudier neighbour in the centre of the hall, is chaster and more elegant, and better fitted for an ordinary drawing-room. It is about four feet high, and consists of loops and festoons of crystal drops on gilded chains, encircled at the bottom by a ring of fourteen lamps; and inclosing higher up a single incandescent bulb of ruby glass under a bell shade of the same material. The use of coloured glass for the vacuous bulb itself is illustrated here, and shows how the light can be tinted to harmonise with any interior furnishing, or suit the taste and eyesight of individuals. The brilliance of the glowing carbon in a transparent bulb is not too strong for the ordinary eye to look at with impunity; but persons of weak sight may have it reduced by the use of clouded bulbs, and students, or those suffering from diseases of the eye can employ bulbs of green or blue glass. Photographers, too, can have recourse to ruby lamps in the development of their negatives.

On the right side of the stage there is a third chandelier of gilt brass, with twelve naked bulbs, a number of single lamps on stands or movable brackets, like gas-jets, with turn-cocks, and either naked or shaded by flat conical reflectors of opal glass. Specimens of these are shown in Figs. 1 and 2. Then there are hall-lanterns of brass, inclosing clusters of bulbs, window-lights, a very handsome billiard lamp, containing six set of twin lamps, shaded from the eyes of the players by opal glass reflectors and crimson fringes, and two handsome drawing-room shade-lamps of the same pattern, each containing a cluster of eight bulbs inside, and one being supplemented by four pairs of naked bulbs outside. Bulbs are also shown burning under water, either clear or tinted, to illustrate the use of the incandescent system in fiery mines, and there is a specimen of a regulator lamp by which the power of the jet can be graduated at will like a gas-flame, by simply turning the cock. This lamp is shown in Fig. 3, the lower being the regulator, which acts by inserting the resistance of a series of vertical carbon rods into the circuit. This is done by turning the screw-piece at the base of the cylinder inclosing the bars. The cylinder is perforated to allow the air to circulate and keep them cool.

In the top of the lamp the novelty is the form of the contact surfaces to prevent sparking or breaking the circuit. These are conical, the small cone seen on the top of the figure being forced away from a conical cup on turning the screw plug. The large surfaces of the cones prevent simultaneously separating, and prevent a large spark. A safe-guard for the lamp against a too powerful current is provided in a short lead wire, seen running across the left of the figure. When the current is too strong this wire fuses, and the current of the lamp is interrupted.

[1] Electroller and electrolabra would be the corresponding terms.

In addition to these lamps Mr. Edison also exhibits some very handsome sconce mirrors supplied by Messrs. Verity and Sons. One of these is a novelty in its way, since the bulb lighting it is inside the frame, and therefore out of sight. The interior of the frame is, however, whitened, and reflects the light out through narrow panes of clouded glass which flank the central mirror, and the face of the spectator thus illuminated can be seen in the

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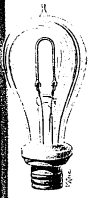

FIG. 1.

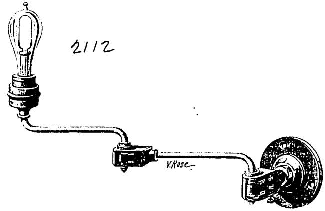

FIG. 2.

mirror. This is another effect which could not be produced by gas. The other sconces are lit by naked bulbs, supported by in front of the mirrors, curving brass brackets in which the ruling idea of foliage and flower or fruit is elegantly worked out.

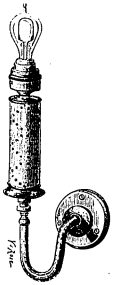

FIG. 3.

In the Concert Room, opposite the Entertainment Court, there are some 280 lamps, about forty of which are termed "half-lights," that is, giving 8 candle-power, or a light one-half of the full 16 candle-lights. Of these 120 are hung in festoons between the pillars of the galleries, the rest being suspended in sets of four under the galleries, or fixed within a large crystal lustre suspended from the roof, and looking like a nest of diamonds. In the Entertainment Court and Concert Room together there are nearly 500 lights, and the stalls in the wide avenue leading to the railway station, have yet to be lighted. In all there will be about 700 lamps required when the exhibit is complete. To drive the 500 lamps now going there are eight

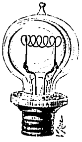

FIG. 4.

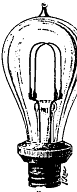

FIG. 5.

dynamo-electric machines at work, and four more are being got ready for the remaining 200 lights. Three Robey engines of 25 horse-power nominal are planted to work these machines, one engine to every four machines. It is usual to allow ten lamps to each horse-power, but what the actual power consumed may be is difficult to state.

The lamp itself consists of a strong bulb of glass about the shape and size of a large Jargonelle pear, say $4\frac{1}{2}$ inches long by $2\frac{1}{2}$ inches in diameter at the thickest part. From the narrow end a tube of glass projects nearly half-way into the bulb, and contains the ends of the copper

conducting wires or electrodes. The inner end of this tube is closed by a flat keel of solid glass, but the wires pass through this into the upper part of the bulb, where they are connected by an electrotype of copper to a fine loop or arch of carbonised woody fibre cut from the silicious skin of the bamboo cane. Mr. Edison exhibits specimens of bamboo from China, Japan, and South America, as well as fibres from Brazil, which he has tested in seeking a good and durable carbon for his lamp. He shows also a number of samples of the carbonised loops made by simple charring in a crucible or by treatment after the Berthollet process, as well as loops of pure graphite very carefully cut. What the particular bamboo is that he has finally adopted we have never been able to learn, but it is probably a variety of the "Shikakuahikee" of Japan, which yield a very close and even skin. The carbon loop is about 2½ inches high, and 1 inch wide, and is so fine that its electric resistance is about 100 ohms. in the "16-candle lamps," and about 50 ohms. in the 8-candle lamps. All the lamps at the Crystal Palace are plain single loop lamps; but sometimes Mr. Edison combines two or more loops, as shown in Figs. 4 and 5. These loops can either be coupled up "in series," or "quantity," and instead of making the loops plain they may be curled into a spiral form. The air being exhausted from the bulb there is no oxidation of the carbon after a short time and Mr. Edison claims that his lamps will last 1000 hours. This at an average rate of between three and four lighting hours per night would give a life of nine months to each lamp; but the estimate may be found a little partial in practice: for though the carbon does not burn, it is doubtless slowly dissipated by the wasting action of the gases and the energy of the current. As Mr. Edison claims to make the lamps at a shilling each, their durability is not so very important as it might at first appear. The Edison dynamo electric machine consists of two vertical electromagnets inclosing between their lower pole pieces of soft iron, a revolving armature. In the armature the usual coils of insulated wire are replaced by longitudinal bars of copper of trapezoidal section insulated from each other by brown paper. These bars are connected to the slips of the commutator in such a manner as to give a continuous circuit through the bars and a continuous current to the brushes when the armature revolves. The main conductor conveying the current from the machine consists of a solid rod of copper in

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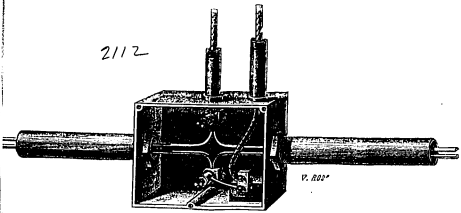

FIG. 6.

cross-section, like a segment of a circle. Two of these rods, the outgoing and return wire, are inclosed a little apart in the same iron pipe and insulated by a black compound resembling Thomson's wax. Branch-conductors in the form of cables for side-streets are connected to the mains in a joint-box shown in Fig. 6. This consists of an iron box in which the mains are connected to two iron terminals. One branch cable is connected to one of these terminals direct, and the other through a short piece of lead to the other terminal. The lead acts as a safety-valve in fusing if the current is too powerful. The box is hermetically sealed, to keep the inside dry. The conductors led into the houses are of a still smaller size, having a diameter of from two to three millimetres; but throughout the whole system the going and returning wires keep together, and the lamps are simply connected across between them. In each lamp, too, there is a similar safety connection of lead to protect the carbon if the current is too strong.

The incandescent system has evidently been brought to great perfection by Mr. Edison, backed as he is by plenty of capital and skilled assistance. Although the idea of it is not new, and was patented in England by Mr. Starr in 1845, Mr. Edison deserves great credit for working it out in so practical a form. Starr described a vacuous bulb of glass containing a thin rod of carbon rendered incandescent by the passage of the current, and Mr. Edison found in this the rough pebble which he has cut and polished with so much success. Moreover, he saw the merits of the incandescent system for domestic lighting at a time when other electricians were giving all their attention to the arc light; and therein showed his genius and foresight. For it is evident now to electricians that while the arc light is well enough adapted for the lighting of large areas, it is unsuitable for small interiors. The practical success of Mr. Edison's system is not thus far a complete justification of his early promises, for the cost is still an unknown quantity, as far as the public are concerned, and there are strong reasons for believing that it will not nearly be so low as the startling figure held out in 1878.

NOTES

AT the annual meeting of the Geological Society the medals were presented as follows:—The Wollaston Gold Medal to Dr. Franz Ritter von Hauer, Director of the Austrian Geological Survey; the Murchison Medal to Prof. Jules Gosselet, of Lille;

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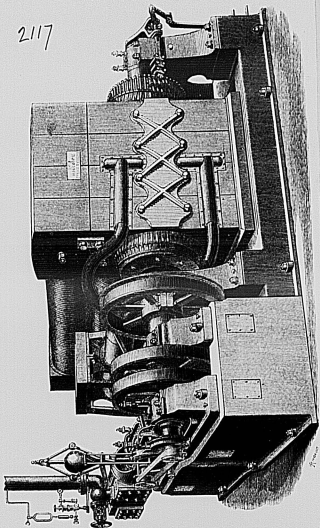
THE EDISON DYNAMO-ELECTRIC GENERATOR.



THE EDISON SYSTEM OF ELECTRIC ILLUMINATION.

We have from time to time, in the pages of this journal, referred to the many interesting and ingenious devices introduced by Mr. Edison in connexion with electric illumination, and which have gone to develop and build up the present very complete and well-elaborated system of incandescence electric lighting which bears his name, and which formed one of the most attractive exhibits at the Exhibition of Electricity at Paris, as it does at the present electrical display at the Crystal Palace. In a short time, however, the public will have an opportunity of seeing its practical and extensive application to ordinary purposes by the lighting of the street lamps, and most of the shops and warehouses, throughout the whole length of the Holborn Viaduct in London, including part of the General Post Office, and the whole of the City Temple, for this installation is in a very forward state, and is rapidly approaching completion.

In our issue of the 21st of October of last year° we illustrated and described the great Edison dynamo-electric generator which was so much delayed in its transmission from New York to the Paris Exhibition, but which after it was set to work, illuminating as it did nearly a thousand sixteen-candle lamps formed so attractive a feature of that unrivalled exhibition. In the present notice we propose to describe another enormous electric generator of improved construction, two of which have recently been brought over from New York and erected at the offices of the Edison Electric Light Company on the Holborn Viaduct, for the working of the installation above referred to. In this installation there will be no less than a thousand full size, or sixteen-candle incandescence electric lamps maintained constantly in operation and which are distributed as according to the list given in the next column. All these lamps will derive their current from one of the two machines which are fixed in the basement of the company's offices, the other machine, which is very similar, being kept in reserve in the event of any accident occurring to the working machine, as well as to take its place during periods of repairs.

	Number of Lamps.
In the street lamps for the whole length of the Holborn Viaduct, that is to say, extending from the Old Bailey to Hatton Garden (two Edison's lamps in each lantern)	200
In the illumination of Dr. Parker's City "Temple"	175
In the central station and offices of the Edison Electric Light Company ...	150
In Messrs. Spiers and Pond's Viaduct Hotel Restaurant and Buffet	75
In one wing of the General Post Office...	50
Distributed in small numbers throughout the warehouses and shops on the Holborn Viaduct	650
Total	1000

The illustration on the opposite page is a general view of one of these interesting machines, which consists of an enormous dynamo-electric generator, similar in general design to the great machine at the Paris Exhibition, but differing in several important details of construction, placed side by side upon the same bedplate and foundation with a horizontal high-pressure Porter engine of 130 horse power, the main shaft of which is a prolongation of the axis of the armature of the generator.

Upon referring to the illustration it will be seen that this generator is of the Edison horizontal type, the magnetic field being produced by a battery of twelve horizontal electro-magnets disposed in three rows of four magnets each, two rows being attached by their ends to the upper pole-piece, and one row to the lower pole-piece, the further ends of all being united by a massive heel plate, seen at the back of the figure. The armature is driven at a speed of 350 revolutions per minute, within a cylindrical space bored out of the very massive pole-pieces shown in the front of the illustration, and which are built up of twelve heavy blocks of cast iron held together by long bolts threaded through them, and by surface coupling plates screwed on to three of their faces. The armature, like that of the Paris machine, is of cylindrical form, and is composed, first of a core built up of no less than 2200 discs of very thin sheet iron, alternating with discs of tissue paper, while at every foot measured in the direction of its length, is a disc of thick iron to give stability and rigidity to the armature; the whole is squeezed and bolted together by eight longitudinal bolts passing through all the discs, and through a pair of end-plates by which the pressure is applied, and the whole is bushed with a tube of wood, so as to insulate the armature core from the rest of the machine. The induction portion of the armature is composed of 108 straight longitudinal thick bars of nearly pure copper of trapezoidal cross-section, arranged at equal distances around the core and insulated from it. These 108 copper bars are united at alternate ends to as many copper discs, half of which number are strung on to the shaft at one end of the armature and the other half at the other; all the discs are insulated from the shaft and from one another, and the bars are so connected with them that the bars and discs together form a continuous and closed circuit, wound as it were longitudinally around the core. This coupling up is effected as follows: each of the copper bars is connected at each end to the edge of one of the copper discs, and the diametrically opposite edge of the same disc is connected to the corresponding bar at the opposite side of the armature; this bar in its turn is connected to one of the discs at the other end, and the opposite edge of this disc is connected to the bar next in rotation to the bar we started with, this again to the next disc at the other end, until all the bars and all the discs have been connected together in such a way that a current of electricity transmitted through the armature would pass along one bar, then across the disc at one end, back by the corresponding bar on the opposite side, then across a disc at the other end to the second bar, along that to No. 2 disc and back on the opposite side to another disc, so that for all electrical purposes the bars and discs together may be looked upon as making up a thick copper coil of extremely low resistance, wound longitudinally over an iron cylinder in a single layer, the various convolutions of which being at equal angular distances apart around the circumference of the cylinder.

In the disposition of the inductive portion of this armature it is identical with the armature of the ordinary Siemens direct-current machine, but the coupling up is simpler, and the course taken by

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the currents produced is in consequence somewhat different.

The diameter of the armature when complete is 28 in., its length is 5 ft., and its weight is over four tons. When it is remembered that this mass is revolved within the hollow cylindrical space between the pole-pieces at a speed of 350 revolutions per minute, it will readily be anticipated that if the heavy bars of copper were attached to the armature only at their ends, which are between 4 ft. and 5 ft. apart, and revolving as they do at a circumferential speed of 43 ft. per second, the armature would be speedily destroyed by the bars flying out under the influence of centrifugal force, and coming in contact with the iron pole-pieces which embrace them. To prevent this, the bars are held together at short distances along the length of the armature by coils of steel piano-forte wire bound tightly round the bars over bands of mica, by which they are insulated from them, and some idea may be formed of the high class workmanship and fitting together of this finely constructed machine when we state that although the diameter of the revolving armature is 28 in., that of the cylindrical space within which it revolves is only $28\frac{1}{4}$ in., thus allowing but one-eighth of an inch clearance between the induction bars and the pole-pieces. It is needless, of course, to point out that this accuracy of construction adds very considerably to the efficiency of the machine, by enabling the armature to revolve in a more intense magnetic field than if, through less accurate workmanship, the magnetic poles, to insure the safety of the machine, had to be farther off.

The electro-magnets by which the magnetic field is produced, consist of twelve horizontal cylindrical bars of iron about 8 ft. long, and coiled throughout their whole length with thick insulated copper wire. The coils of these magnets are connected together in two parallel circuits of six coils each, and the resistance of the circuit so arranged, and which form a derived or shunt circuit to that of the machine, is 21 ohms. The resistance of the armature, as will be apparent from a consideration of its construction is practically inconsiderable, measuring only about $\frac{5}{10,000}$ of an ohm (.00049 ohm).

The commutator is a cylinder built up of a number of insulated copper sections as in that of the Siemens and Gramme machines, there being as many copper segments as there are induction bars on the armature, and are connected to them by as many radial copper rods attached in such a manner that owing to a slight elasticity at the junction there is no tendency for them to be sheared off in the starting and stopping of the machine, a defect which showed itself in the machines of this type which were first constructed. Upon the cylindrical surface of this commutator are pressed two sets of metallic brushes or collectors mounted in spring fittings attached to a rocking arm—shown to the extreme right of the illustration—by which the angular position of the points at which the brushes make contact with the commutator can be adjusted with respect to the neutral plane of the magnetic field so as to obtain the maximum efficiency of the machine.

The motive power is a horizontal engine of the Porter type, of 130 horse power nominal, fitted with a Porter governor and expansion gear, and with a steam pressure of 120 lb.; it drives the armature which is mounted on the crankshaft at a velocity of 350 revolutions per minute, the steam being supplied by one of Messrs. Babcock and Wilcox's compound tubular boilers. The weight of the machine with its engine and bedplate, which is common to both, is over 20 tons.

In order to keep the armature cool, thereby protecting its insulation and keeping down its resistance, there is a small blowing fan driven by the engine, and from this blower three pipes are led which communicate with three air channels cut through the pole-pieces, so as to maintain three jets of air constantly impinging on the middle of the rotating armature, which, escaping right and left are, during the working of the machine, continually bathing the induction bars with air. The efficiency of this arrangement is proved by the fact that streams of perceptibly warm air are, when the apparatus is in action, continually issuing from the two ends of the hollow cylindrical space within which the armature is rotating.

The Edison incandescence lamps, which will be worked on the Holborn installation, possess the general features common to the incandescence lamps of all the systems at present in use, that is to say, they consist of a fine filament of carbon enclosed in an exhausted glass envelope and rendered incandescent by the passage through it of a current of electricity of sufficient strength. We need not refer to all the distinguishing characteristics of this interesting lamp in the present notice, because we intend on an early occasion to give a detailed description of it as well as the method of its construction. It is sufficient for our present purpose to point out that the features which distinguish the Edison lamp from those of Mr. Swan and others is the material of which the carbon filament is made, and the arrangements by which it is placed in circuit with the source of electricity or generator. The incandescent filament in Mr. Edison's lamp is made of carbonised bamboo fibre, while that of Mr. Swan is of cotton carbonised by a special process, thus differing again from the filaments in the Maxim and Lane Fox lamps, the former of which is prepared from paper treated in a residual vapour of gasoline, while the latter consists of carbonised vegetable fibre prepared by a very similar process. The fitting of the Edison lamp is exceedingly simple and efficient, consisting of a brass cone and a brass screw forming the terminals of the carbon filament, but otherwise insulated from one another by plaster-of-paris, and this little device, which is attached to the stem of the lamp, screws into a corresponding and similarly put together socket consisting of a hollow brass cone and a hollow screw, which are respectively in electric communication with the conductors leading from the generator. When the fitting of a lamp is screwed into this socket the cone on the lamp is, by the action of the screw, drawn firmly into its conical seat, and thus good metallic contact is insured not only between the two cones but also between the corresponding threads of the two screws, and thus the resistances of joints is reduced to a minimum, and it becomes almost impossible for any of the current to be lost by faulty connexions.

The conductors employed on the Holborn installation are similar in construction to those exhibited in Paris, and consist of a pair of copper rods of segmental cross-section enclosed in iron gas tubing, the intervening and surrounding space being filled with a bituminous insulating compound. These double conductors or electrical mains are made in a number of sizes, the cross-section of the copper bars, and therefore the diameter of the encasing tubing, being proportioned to the current it is intended to transmit. They are laid along the subway of the Viaduct, branches—the details of which we shall describe in another notice—being taken off at places along their length corresponding to groups of derived circuits or to the various houses to which the current is supplied, and the branch conductors employed for this purpose being similar to in construction, but smaller in size, than the great supply mains with which they are connected.

In order to render impossible the occurrence of fire through the undue heating, through any cause, of conductors, as well as for the protection of the lamps, every branch and sub-branch and smaller

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derived circuit throughout the whole system is fitted, at the point where it joins its corresponding superior main, with a safety guard or cut-off, consisting of a short length of lead wire or other easily fusible conductor through which the derived current entering the branch from the main is transmitted, and which as long as the strength of the current is not abnormally great, transmits it, as does any other portion of the branch. The moment, however, that from any cause the current becomes strong enough to do damage, the lead wire is fused by it, and the particular branch which would otherwise be liable to injury is cut out of the circuit without in any way interfering with the rest of the main circuits or their branches.

Forming an important part of the Edison system are the arrangements for the regulation of the strength of the current to the work it is required to do at any one moment, and this is performed for a whole district entirely in one room at the central station. We shall describe this very characteristic and well-developed feature of the system later on, but we may briefly say that the current passing out of the central station is controlled by a regulator which by varying the resistance of the circuit of the field magnets of the machine, regulates the intensity of the magnetic field and thus weakens or strengthens the currents induced in the armature with a proportionately decreased or increased expenditure of motive power and therefore of consumption of fuel. In the regulating room is an electro-motive-force-indicator consisting of a balanced reflecting galvanometer making its indications by the movement of a spot of light upon a divided scale and showing instantly to the assistant in charge any variation of strength of current produced throughout the whole system by the turning on or extinguishing of any series of lamps. A supplementary indication is also given by the behaviour of a small series of "pilot lights" in the regulating room and included in the general circuit.

The electricity supplied to each consumer will be measured by a most ingenious meter (which we shall describe in a future notice), placed on his own premises, and under this system those who make use of the light will be as independent of the persons in charge of the apparatus at the central station as gas consumers are at the present moment of the employés at the gas works. They will have complete control of the lights on their premises, and can turn on or extinguish any or all of their lamps without any communication with head-quarters for the *demand* for electricity, in other words, the number of channels opened to the current at any one time is instantly indicated in the regulating room, and the *supply*, that is to say, the strength of the current, can as instantly be adjusted to it.

The arrangements of this very interesting installation have been carried out under the management of Mr. Edward Hibberd Johnson, who is the representative of Mr. Edison in this country in all matters connected with the electric light, and to whom we are indebted for much information.

Within the limits of a preliminary and introductory article, such as this is intended to be, it is impossible to do more than indicate the general features of a system consisting of so many points of interest, but we have in the present notice gone over sufficient ground to show that if the panic was premature which was produced in the gas-share market some three years ago by the announcement that Mr. Edison had elaborated a complete and practical system of electric lighting to compete successfully with gas on all its points, Mr. Edison has since made good his claim to the laurels he was thought to have lost by the natural collapse of an unreasonable scare, for, if the permanent working of the installation on the Holborn Viaduct prove as successful in its results as those of the experimental trials have—and there is no reason to suppose it will not—there can be little doubt that an era is opening for electric illumination greater in magnitude and importance than has ever preceded it. And we need hardly say we hope that such may prove to be the case.

THE INVENTOR OF THE SWAN ELECTRIC LAMP.

MR. J. W. SWAN, who lectures at the Royal Institution to-night on electric lighting, with special reference to the comparative cost of gas and electricity, is well known as the inventor of the incandescent electric lamp which bears his name. Mr. Edison in America and Mr. Swan in England succeeded simultaneously in discovering the conditions necessary to obtain permanence in the carbon filament of the incandescent lamp. The idea of using carbon filaments in vacuo for producing electric light is at least thirty-seven years old; and since 1845, when a patent was taken out for the purpose, down to the other day numberless experiments were made, but without success till little more than twelve months since, when it was discovered on both sides of the Atlantic that by reducing the lamp to its most elementary form, and by using nothing but glass, platinum, and carbon in its construction, it was possible to solve the problem successfully. Mr. Stearn, of Birkenhead, helped Mr. Swan to his high vacuum by aid of a Sprengel pump; and after a long series of careful experiments the Swan electric lamp was produced, which has done so much to make electric lighting a domestic institution both at home and abroad. Before that date the arc system, with its burning carbons, was spreading far and wide as an illuminant of public places; but the domestication of electricity may be said to date from the discovery of the Swan and Edison electric lamps. The incandescent light—in which a thin filament of carbon, enclosed in a pear-shaped glass from which all air has been exhausted, is raised to a white heat by the electric current—depends for its success upon the cheapness and durability of the carbon filament. Mr. Edison makes his of bamboo; Mr. Swan employs a cotton thread treated with sulphuric acid of a specific gravity of 1,440. When cotton fibre is subjected to acid of this strength it enters into a state of semi-solution, and if the process of change is arrested by washing it in water it is found that the fibres become as it were all glued together in one homogeneous mass. Thread so treated much resembles cat-gut both in appearance and in strength. Carbon filaments produced from this material are extraordinarily solid and hard. The cost per lamp is about five shillings, and the average duration in Earnock Colliery is said to be more than 700 hours. Mr. Swan maintains that many of his lamps have lasted more than a thousand hours, and are still doing duty. The duration of the lamp depends, however, so much upon the degree of incandescence that calculations as to the average life of a lamp are worthless unless something is known about the conditions under which it is used. It is upon this question that everything hinges. If the lamp could be produced more cheaply, or if its durability could be doubled, it would soon prove the most formidable competitor gas has yet had to encounter. Its light is perfectly steady, white, and clear. It is said to be equal to sunlight for discerning the finest shades of colour. Lamps can be made of any number of candle-power from one upwards, and the loss on, say, a single-candle incandescent lamp is less than in burning an equally feeble gas-jet. Two hundred and fifty to three hundred candles per horse-power is the rate of illumination on the incandescent system. Mr. Swan calculates that, whereas 2 cwt. of coal will make 1,000 cubic feet of gas, giving a light of 3,000 candles for one hour, the same quantity of coal employed in generating electricity by the dynamo electric machine will give a light equal to 30,000 candles for the same time. This gives an apparent advantage in favour of the electric lamp of ten to one; but as all the coal is used in generating electricity, whereas in making gas the residual products are worth almost as much as the gas, the advantage is reduced by 50 per cent., and the balance is still further reduced by the necessity for replacing lamps where electricity is employed—a necessity which does not exist in the case of gas. Mr. Swan calculates, however, that when all deductions have been made his lamp is thrice as cheap as gas. Even if this calculation is too sanguine, the advantages of the lamp are sufficiently obvious to explain its rapid adoption. It is best known to Londoners by the 1,200 lamps which light up the Savoy Theatre.

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But it is also in use in the offices of the British Museum, the Winter Exhibition of the Royal Academy, and the saloon of the Mansion House. It is employed in mills at Paisley; drapery establishments at Newcastle and Sheffield; and the Earnock and Risca collieries are partially lighted with this lamp. It is used on board many English and French steamers, and the French man-of-war the *Redoutable* is also being fitted with the Swan lamp. It is about to be introduced into the Louvre and into the Hôtel de Ville, Paris, and there is a large and complete installation at Barcelona.

The future development of this method of lighting depends upon the formation of local companies, corresponding to gas companies, undertaking the supply of electricity. When one such company is successfully established, the rate of growth will doubtless be very rapid. One feature of the new industry which electric lighting creates is the increased employment it will give to women. At Mr. Swan's factory at Newcastle over a hundred hands are constantly employed under a lady superintendent. The present outturn of lamps is between 4,000 and 5,000 per week. Mr. Swan is also about to undertake the construction of secondary batteries, but on the whole he prefers Siemens's dynamo, on what is termed the Hunt principle. In his lecture to-night he will deal not so much with the intrinsic merits of the incandescent lamp as with its economy compared to that produced by gas. This is, of course, the vital point, and it gives to the lecture more practical importance than might at first have been inferred from its title.

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THE CITY PRESS, SATURDAY, MARCH 11, 1882.

VISIT OF THE CITY LANDS COMMITTEE TO THE ELECTRIC EXHIBITION.

There was no doubt as to the general impression produced upon the City Lands Committee by their visit to the International Electric Exhibition at the Crystal Palace on Wednesday. It was an impression of the most favourable kind, and considerably strengthened by some remarks on the important point of the cost of the new light which, at the dinner that followed the visit, fell from the chairman of the Commission of Sewers. In a scientific point of view it was not of course possible to get much absolute information from a hasty and superficial inspection such as the committee were restricted to on this occasion, but some general facts were gathered which will doubtless be treasured up for future use. To a visitor not furnished with special and technical knowledge of the subject it would be no easy matter to apportion the merits of the several competing companies; to say which of the arc lamps exhibited is the best, and why it is the best; and in what circumstance one kind of incandescent lamp is superior to another. But it is impossible to deny merit to any one of the exhibitors, for as a matter of fact there is nothing shown that is not good in its way. The committee went in a professional capacity, and it will be for them after further examination and fuller consideration to decide which of the lights exhibited here is the most suitable for the purpose they have in view; but speaking in the most general way, we may safely say that they were very well satisfied with everything that they saw on this first visit. One important thing to be learned from the exhibition is that the principle of the subdivision of the light seems to have been satisfactorily arrived at. A short time ago we were told on all sides that the electric light would be of no use to us in our houses, because it was not capable of minute division, but facts have now completely disproved this assertion. The light may be as readily used in the smallest room of a small house as in the largest public hall or for the illumination of great open air spaces. A capital instance is afforded by the Domestic Electric Lighting Company, who, "being desirous of showing to the public the convenience and safety of the electric light and its adaptability to modern requirements," have arranged a suite of rooms at the Palace, so as to exhibit the domestic and practical uses of the incandescent lamp. The system used is Edison's, whose incandescent lamps consist of a small glass globe (from which the air has been exhausted), enclosing a thin thread or loop of carbon through which the electric currents are passed. Upon the electric currents being turned on, this loop of carbon is heated to a state of incandescence, and gives out an extremely brilliant light. To witness the effect of the light in a large room—the concert room, for instance, which is lighted by similar lamps—it might be supposed that it would be altogether too powerful for a small room, but in fact, no softer or more agreeable illumination could be imagined than that shed from the tiny incandescent lamps over these small apartments, furnished in the richest and most elaborate style. A drawing-room and boudoir, decorated by Messrs. J. and H. Cooper, of Great Pulteney-street, and lighted by the Edison Company, offered a remarkable combination of the luxurious styles of an old world and a new. Much has been said, and truthfully, as to the beautiful effect of the light in the courts of the Palace. The Mediæval Court, the colouring of which has never before been seen to advantage, is charmingly illumined by a single arc lamp of 2,000 candle-power, one of the exhibits of the Electric Light and Power Generator Company, who light also the Roman Court and the northern end of the nave, and whose giant chandelier exhibiting the "Maxim" incandescent light is one of the features of the exhibition. The richly-coloured Alhambra Court shows magnificently under the lamps of the Anglo-American Brush Electric Light Corporation; 600 incandescent lamps, from 10 to 100 candle-power, of the Lane-Fox type are shown here; and other notable exhibits of this company are the single arc light of 150,000 candle-power, and 40 arc lights of 2,000 candle-power to be seen in the Tropical Section and Byzantine Courts. The British Electric Light Company are exhibitors of arc and incandescent lamps in the Italian and Egyptian Courts and the north nave. Mr. R. E. Crompton occupies the centre transept and the Chinese Court with lamps similar to those now in use in the Egyptian Hall of the Mansion House. The Handel Orchestra and the Pompeian House are lighted by Pilsen and Joel lamps shown by Messrs. Rowatt and Tyfe, of Queen Victoria-street. Messrs. Siemens make an extensive display at the south end of the Palace; and the "Swan," the "Jablockhoff," and the "Mackenzie," amongst the varieties of the light which were brought under the notice of the committee by Major Flood Page, who acted as their very capable guide. Mr. Edison's company ("Edison Electric Light System"), represented by Mr. Edward H. Johnson, have taken a foremost place at the exhibition, and their incandescent lamps in the concert-room, the Entertainment Court, and the Industrial Avenue are as powerful, as pleasing, and as well regulated as any that are shown. Mr. Johnson, who was most attentive to the committee, showed in various ways how perfect was his control over the various lamps in his sections, and then took his visitors below stairs to the machine-room, and pointed out the twelve powerful engines which supply the total volume of electricity. So perfect is the mechanical system that Mr. Johnson is able to throw out first one and then another of the machines with this result only, that the intensity of the rays given from the various lamps is diminished by one-twelfth and one-sixth, not one of the lamps being extinguished; and by means of a regulator the lights are turned up or down as with a common gas-burner. The Edison Electric Light System proper, Mr. Johnson explains, contemplates the establishment of large central stations as the source of electrical supply, the universal distribution of electricity within the area of the present gas limits by means of conducting mains, sub-mains, service conductors, &c., laid in the streets, and the supply of the electric energy to the individual consumer for the purposes of light, heat, or power, through an electrical meter, placed on the consumer's premises—in short, to supply electricity in a manner exactly analagous to the mode of gas supply. Incidental to the above, and as an auxiliary department, provision is made for the supply of "isolated" plants, that is, small engines, dynamos, and lamps, to be placed on the premises to be lighted. The operations of this department will be confined mainly to factories, mills, and large works generally, located outside the limits of gas supply. The apparatus used for this purpose has been adopted by Mr. Edison with the view, primarily, of obtaining the highest economy. It consists of four distinct heads, viz., the steam-engine, the Edison dynamo, the Edison fire protector, and the Edison incandescent lamps, the combination affecting a conversion of steam power into light, for which it is claimed that it is more economical than any other yet presented to the public. From their establishment on the Holborn Viaduct the company intend shortly to supply electricity by meter to private houses, the householder to have complete control over his own supply, and the payment to be regulated solely by consumption. When this is done the reign of electricity will surely have commenced in good earnest. 2132

After their tour of inspection, which occupied some two hours and a-half, the committee dined together at the Palace, under the presidency of Mr. J. Wheeler, their chairman. Amongst those present were: Alderman Sir R. W. Carden, M.P., Alderman Sir F. W. Truscott, the Comptroller, Mr. Deputy Atkins, Mr. Deputy Fisher, Mr. Deputy Edmeston, Mr. Deputy McGeorge (chairman of the Crystal Palace Company), Major Flood Page, Mr. J. Finlay, Mr. S. T. Day, Mr. F. H. Mitchell, Mr. J. V. Moore, Mr. I. Wilcox, Mr. H. Woods, Mr. J. E. Walford, Mr. G. R. Tyler, Mr. G. M. Felton, Mr. J. W. Goodinge, Mr. J. Lindsey, Mr. G. Manners, Mr. T. Woodley, Mr. W. Creasey, Mr. Washington Lyon, Mr. J. Crawford, and Mr. J. Gannon (Hallkeeper). After dinner, a brief toast list was disposed of. The Chairman, who presided, proposed first "The Queen," and found a few kindly and loyal words to say on the painful event which has been in the minds of all Englishmen for the past ten days. In giving "The Corporation," the Chairman spoke of its liberality and zeal for reform. Of the Lord Mayor he said that if he had a fault it was a too great appetite for work. His lordship would yield to no one in his anxiety to stand well in the estimation of his fellow citizens, and of the whole of England. The toast was briefly responded to by Alderman Sir R. W. Carden, who in turn gave "The Health of the Late Chairman," this compliment being acknowledged by Mr. S. T. Day. The Chairman then called upon the company to drink to Mr. Deputy McGeorge, observing that since he had occupied the chair of the Crystal Palace Company there had been a marked change for the better in the management. He sincerely trusted, that the very interesting exhibition which they had inspected that evening would prove in every sense of the word a success. (Hear, hear.) Mr. Deputy McGeorge, in returning thanks, said he desired it to be understood that the initiation of the electrical exhibition was due to Major Flood Page, who had undertaken and manfully discharged the great burden of the work. (Hear.) He was very glad to see the City Lands Committee at the Crystal Palace that evening. He had himself occupied the post of chairman of that committee some ten years ago, and had ever since taken the deepest interest in its proceedings. He hoped their visit would enable them to become more conversant with the systems of electric lighting now before the world. His own opinion was that the electric light would never go out in the City. The Chairman proposed "The Health of Alderman Sir F. W. Truscott," expressing pleasure that that gentleman had been placed at the head of the committee which was charged with no less a responsibility than the preservation of the Corporation at a critical and difficult period

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Alderman Sir F. W. Truscott replied to the toast, referring to his long connexion with the Corporation, and to the motives which had induced him to bring forward his motion for the appointment of the special committee. Mr. Felton returned thanks for "The Chairman of Committees," and said that they wanted to get for their constituents the very best light; they did not care whether gas or electricity. (Hear, hear.) They wanted the City to be the best-lighted city in the world, and he hoped that one day it would be lighted throughout by the new light. He might tell them that one of the electric light companies lighting a section of the City had made the Commission of Sewers an offer which was cheaper than the rates of the gas companies. (Hear, hear.) Mr. Walford gave "The Health of Major Flood Page," thanking him for the great courtesy he had shown to the committee that day. The toast was drunk with much cordiality (the Chairman rising to add his own thanks), and Major Page, in responding, expressed a hope that the committee would visit the Palace again, for it was not possible that in one brief visit they could have learned all there was to learn—(hear)—and quoted the opinion of an expert that the Crystal Palace Exhibition was far superior to the exhibition recently held in Paris. At about ten o'clock the meeting broke up, and the committee returned by train to town.

The Daily News
March 1882

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THE ELECTRIC LIGHT.

Mr. J. W. Swan, the well-known electrician, lectured on the above subject last evening at the Royal Institution, directing his remarks chiefly to the mode of lighting known as the "incandescent." He might fairly say that the difficulties encountered in the construction of incandescent electric lamps had been conquered, and that their use was economically practicable. They knew by actual experiment that continuous heating to a fairly high degree of incandescence during 1,200 hours did not destroy a well-made lamp. What the utmost limit of a lamp's life might be they did not know. Probably it would be an ever-increasing span; as, with increasing experience, processes of manufacture were sure to become more and more perfect. Taking it, therefore, as fully established that a cheap and durable lamp could now be made, the further question was as to the cost of the means of its illumination. The cost of producing light by means of electric incandescence might be compared with the cost of producing gas light in this way: 2 cwt. of coal produced 1,000 cubic feet of gas, and this quantity of gas, of the quality called fifteen-candle gas, would produce 3,000 candle light for one hour. But besides the product of gas, the coal yielded certain bye products of almost equal value. He would, therefore, take it that they had in effect 1,000 feet of gas from one cwt. of coal instead of from two, as was actually the case. The one cwt. of coal would give fifty horse power for one hour. Repeated and reliable experiments showed that they could obtain through the medium of incandescent lamps at least 200 candle-light per horse power per hour. But as there was waste in the conversion of motive power into electricity, and also in the conducting wires, he made a liberal deduction of 25 per cent., and took only 150 candle-light as the nett available product of one horse power. For fifty horse power, the produce of one cwt. of coal, they had then 7,500 candle-light, as against 3,000 candle-light from 1,000 feet of gas. That was to say, two-and-a-half times the amount of light which the gas from the same quantity of coal was capable of producing. There remained, however, an allowance to be made to cover the cost of the renewal of lamps. There was a parallel expense in connection with gas lighting in the cost of the renewal of burners, globes, chimneys, &c. He could not say that those charges against gas lighting would equal the corresponding charges against electric lighting, unless they imported into the account—as he thought it right to do—the consideration that unless minute attention be given, far beyond what was actually given, to all the conditions under which the gas was burned—nothing like the full light product which he had allowed to be obtainable from the burning of 1,000 cubic feet of gas, would be obtained. Taking that into account, he thought but little, if any, greater allowance need be made for the charge in connection with the renewal of lamps in electric lighting than ought to be made for the corresponding charges for the renewal of gas burners, globes, chimneys, &c. But it would be seen that even if the cost for renewal of lamps should prove greater than the corresponding expense in the case of gas, there was a wide margin to meet it before they had reached the limit of the cost of gas lighting. He thought, too, it might be fairly placed to the credit of electric lighting, that by this mode there was entire avoidance of the damage to furnishings and decorations of houses, to books, pictures, and to goods in shops, which was caused through lighting by gas, and which entailed a large expenditure for repair, and a large amount of loss which was irreparable. In comparing the cost of producing light by gas and by electricity, he had only dealt with the radical item of coal in both cases. Gas lighting was entirely dependent upon coal—electric lighting was not; but in all probability coal would be the chief source of energy in the case of electric lighting also. When, however, water power was available, electric lighting was in a position of still greater advantage, and in point of cost altogether beyond comparison with other means of producing light. With regard to the cost of plant, there would be a more even balance in the two cases. In a gasworks they had retorts and furnaces, purifying chambers and gasometers, engines, boilers, and appliances for distributing and regulating pressure. Plant for generating electricity on a large scale would consist principally of boilers, steam engines, dynamo-electric machines, and batteries for storage. No such electrical station, on the scale he was supposing, had yet been put into actual operation; but several small stations for the manufacture of electricity already existed in England, and three large stations designed by Mr. Edison were almost completed in America. They were therefore on the point of ascertaining by actual experience what the cost of the works for generating electricity would be. Meanwhile they knew precisely the cost of boilers and engines, and what ought to be the cost of dynamo-electric machines of suitably large size. There were consequently sufficient grounds for concluding that to produce a given quantity of light electrically the cost of plant would not exceed greatly, if at all, the cost of equivalent gas plant. There remained the cost of distribution. Could electricity be distributed as widely and cheaply as gas? On one condition, which he fully hoped could be complied with, that question might be answered in the affirmative. The condition was that it be found practicable and safe to distribute electricity of comparatively high tension. The importance of this condition would be understood when it was remembered that to effectively utilise electricity in the production of light it was necessary that the resistance in the carbons of the lamps should be relatively great to the resistance in the wires which conveyed the current to them. In order to supply the current to the lamps economically there should be comparatively little resistance in the line. Distribution in this manner had the merit of simplicity, and it involved no danger to life from accidental shock; moreover it did not demand great care in the insulation of the conductor. But it had the great defect of limiting within comparatively small bounds the area over which the power for lighting could be distributed from one centre. In order to light a large town electrically on this system, it would be necessary to have a number of supply stations, perhaps half a mile apart. It was evidently desirable, to effect a wider distribution than this, and he hoped that either by arranging the lamps in series, so that the same current passed through several lamps in succession, or by means of secondary voltaic cells, placed as electric reservoirs in each house, it might be possible to economically obtain a much wider distribution. Whether by the method of multiple arc, which necessitated the multiplication of electrical stations, or by means of the simple series or of secondary batteries connected with each other from house to house in single series, the lamps being fed from these in multiple arc, he was quite satisfied that comparatively with the distribution of gas, the distribution of electricity was sufficiently economical to permit of its practical application on a large scale. As to the cost of laying wires in a house, he had it on the authority of Sir William Thomson, who had just had his house completely fitted with incandescent lamps, that the cost of internal wires was less than the cost of plumbing in connection with gas pipes. Referring to the use of carbon as the wick of an electric lamp, Mr. Swan pointed out that excellent carbon filaments could be produced from the bamboo, and also from cotton thread treated with sulphuric acid. The sulphuric acid treatment effected a change in the cotton thread similar to that which was effected in paper in the process of making parchment paper. He exhibited an example of a carbon filament produced from parchmentised cotton thread. The filament, he said, was not more than the ·01 of an inch in diameter, yet a length of three inches, having therefore a surface of nearly the one-tenth of an inch, would give a light of twenty candles when made incandescent to a moderate degree. It need hardly be said that the interesting experiments with which Mr. Swan illustrated his remarks were watched with much interest by a crowded audience, including Dr. Tyndall, Professor Abel, Professor Franklin, and other well-known scientific men.

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Il Sole — Lunedì-Martedì, 13-14 Marzo 1882 — Milano

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Illuminazione elettrica. — Quest'argomento fu trattato domenica con molta competenza dal prof. Colombo nella sua conferenza al Ridotto della Scala.

Passò in rassegna la macchina Gram, il sistema Jablokhoff, quello Siemens e Brush, e finalmente quello Edison. Parlò della scoperta del Paccinotti.

Nel 1876 — disse l'applaudito conferenziere — il problema era press'a poco nello stesso studio di 20 anni prima. La difficoltà di suddividere la luce coll'arco voltaico si presentava ancora intatta. Fu nel 1876 che il problema fu vivamente affrontato da Jablokhoff, da Brush, da Siemens, e si scopersero i regolatori differenziali. Se non che le lampade Brush o Siemens, come ognuno ha potuto vedere nella scorsa estate, vanno per illuminare vasti locali, e piazze e larghe contrade. Si può dir dunque che un solo lato del problema fosse risoluto; mancava di risolverlo per l'illuminazione di teatri, delle case, delle vie strette; e questa vittoria non la poteva ottenere che il sistema incandescente Edison e ottenerla, come lo mostra l'esperimento di Shepherd, completa.

Descrisse quindi le lampade Swan, Lawe-Fox, e Maxime, che riposano sullo stesso principio. Non si può ancora affermare con sicurezza quale tra queste lampade sarà la preferibile; però si può dire fin d'ora che la lampada Edison è la più semplice e la più economica.

Il prof. Colombo parlò poi degli *Accumulatori*, specie di serbatoi di elettricità; ma non crede che ancora si possa su di essi fare un grande assegnamento.

Edison intanto si prepara a illuminare col suo sistema tutto un distretto di Nuova York, e perciò ha inventato anche degli ingegnosissimi regolatori e contatori del consumo di luce elettrica, che sostituisce a quelli che servono pel gas.

Dopo la conferenza, calorosamente applaudita, il signor James Shepherd si prestò a dare alquante spiegazioni ad alcuni che ne lo avevano richiesto, intorno all'applicazione delle lampade Edison. E a provare che ogni pericolo d'incendio è con esse rimosso, fece un esperimento involgendo una lampada accesa con un panno inzuppato di benzina. Quindi con un martello ruppe il vetro. La luce istantaneamente si spense, senza aver tempo di comunicarsi alla benzina.

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CORRIERE DELLA SERA 2142 7 Mars 13-14 1882

L'ILLUMINAZIONE ELETTRICA

A Milano, più che in ogni altra città d'Italia è stato discusso a lungo sulla illuminazione elettrica, sono state pubblicate memorie, se n'è parlato anche in Consiglio comunale, ma l'argomento può essere ancora oggetto di lunghi studi. Per ciò appunto il prof. G. Colombo tenne, ieri alle 2, nel Ridotto della Scala una interessante conferenza. Il pubblico numeroso ha applaudito vivamente l'oratore al suo primo presentarsi; ed il Colombo parlò in istile piano, e in modo da rendersi intelligibile a tutti, per più di due ore. Rifece la storia di tutti i tentativi, di tutti gli esperimenti d'illuminazione elettrica dal 1841 in poi.

Ricordò anche quello del faro collocato nel 1876 nella nostra piazza del Duomo, e spiegando il sistema incandescente venne fino alla luce elettrica che ammiriamo in queste sere nel Ridotto della Scala. Ed a questo punto il pubblico ha goduto di una gradita sorpresa, — tutto ad un tratto i tre lampioni del Ridotto ed una lampada Edison che stava sul tavolo del Colombo si videro illuminati. Il conferenziere disse allora che tale illuminazione verrà a costare meno di quella del gas; il costo maggiore consiste nelle spese d'impianto. Annunciò che Edison illumina ora tutto un distretto di Nuova York col sistema che ammiriamo nel Ridotto della Scala e si augurò che tra breve anche Milano abbia l'illuminazione elettrica in tutte le case.

« — Ma perchè dunque, chiese il Colombo, non si vedono sorgere Società per dare a tutti e dappertutto questa bella illuminazione a sistema incandescente? Ricordò che anche per la diffusione del telefono ci volle qualche anno. Allorchè i vantaggi di questa illuminazione avranno convinto tutti, allora vedremo sorgere forse anche troppe Società. »

Chiuse la bella conferenza parlando brevemente di altre applicazioni dell'elettricità come forza motrice, dicendo al gas: Ti accontenterai di renderti utile a noi per altri usi, quali il riscaldare e cuocere le nostre vivande, ecc. Gli applausi che interruppero già più volte l'oratore nel suo discorso, lo salutarono ancor più calorosi alla fine.

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IL PUNGOLO

7 Mars 14 82

CONFERENZA DEL PROF. G. COLOMBO.

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Per incarico della *Società promotrice di esplorazioni scientifiche in Milano,* il professor G. Colombo ha tenuto nel ridotto della Scala una conferenza sulla illuminazione elettrica dinanzi ad un pubblico molto numeroso.

Questo argomento della illuminazione elettrica, disse il dotto professore, è innegabilmente d'una grande attualità, e Milano, che è un centro di attività vera, ha voluto sanzionare i primi esperimenti di tale illuminazione. Nel 1876 fu collocato nella piazza del Duomo un faro colla macchina Gram. Si comprese fino da allora l'importanza del problema della suddivisione della luce. Jablokhoff parve avvicinarsi alla sua soluzione, colle sue candele poste nel 1878 nella piazza e nell' Avenue dell'Opéra a Parigi; vennero poi Siemens e Brush, i cui sistemi abbiamo veduto l' anno scorso in Galleria V. E. e nell'Arena.

Passò quindi il Colombo a parlare del sistema incandescente Edison e del bell' esperimento fatto in queste sere nel ridotto della Scala, dove egli parlava, mercè l'iniziativa del bravo James Shepherd.

È ora provato che la luce elettrica si può suddividere quanto si vuole; il problema si può dir risolto; ma era soltanto il sistema dell'incandescenza che poteva risolverlo e vincere il gaz.

Discorse l' oratore della scoperta di Pacinotti (a cui fu nello scorso autunno resa giustizia dal Congresso dell' elettricità di Parigi) della macchina dinamo-elettrica.

Fu nel 1876 che il problema di suddividere la luce coll'arco voltaico fu vivamente affrontato da Jablokhoff, da Brush, da Siemens, e si scopersero i regolatori differenziali. Se non che le lampade Brush e Siemens, come ognuno ha potuto vedere nella scorsa estate, vanno per illuminare vasti locali, e piazze e larghe contrade. L'esperimento di Shepherd ha dimostrato aver l'Edison risoluto il problema di dare la luce nei teatri, nelle officine, nelle case.

Disse in che consiste il sistema incandescente, le difficoltà di utilizzarlo attesa la fusibilità dei fili metallici, e della vittoria ottenuta da Edison.

A questo punto il prof. Colombo spiegò la scoperta di Edison, l'adozione da lui fatta della fibra di bambù in un vasetto in cui è operato il vuoto; e a un tratto, si illuminarono tutti tre i lampedari del ridotto, come nelle sere di spettacolo, nonchè una lampada, pure Edison, che stava sul tavolo del professore.

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Parlò questi della brillante applicazione del Shepherd che sostituì alle 92 fiamme a gas, altrettante lampade Edison; disse dei pregi di questa luce e dei suoi vantaggi in confronto del gas, per il colore, per la fissità, per rimosso pericolo d'incendio, e perchè non sviluppa, nè gas nocivi, nè calore.

Tra le lampade elettriche fin qui inventate quella di Edison è la più semplice e la più economica.

La illuminazione Edison costerà meno di quella del gas. Il costo dipende dalle proporzioni dell'impianto; perchè se questo è grande le spese vanno di molto ridotte e la luce verrà a costare pochissimo.

Il prof. Colombo augurò al nostro paese che presto sorga qualche Società per dare a tutti e dappertutto questa bella illuminazione, e rammentò che Edison intanto si prepara a illuminare col suo sistema tutto un distretto di Nuova York, e perciò ha invitato anche degli ingegnosissimi regolatori e contatori del consumo di luce elettrica, che sostituisce a quelli che servono pel gas. Dopo l'esperienza di Nuova York, qual città non vorrà profittare della scoperta di Edison? Io credo, disse, l'egregio professore, che fra due o tre anni noi l'avremo applicata nelle nostre case.

Parlò quindi e fece un esperimento di applicazione dell'elettricità come forza motrice, per dedurre che le correnti fluviali, le cascate delle nostre Alpi potranno venire utilizzate col filo metallico come forza motrice dei generatori elettrici, con gran risparmio di locomobili e di carbone.

Quando la illuminazione elettrica sarà attuata, il gas servirà come mezzo di riscaldamento e per cuocere i cibi.

Terminata la conferenza del prof. Colombo, il signor James Shepherd si prestò a dare alquante spiegazioni ad alcuni che ne lo avevano richiesto, intorno all'applicazione delle lampade Edison. E a provare che ogni pericolo d'incendio è con esse rimosso, involse una lampada accesa con un panno inzuppato di benzina. Quindi con un martello ruppe il vetro. La luce istantaneamente si spense, senza aver tempo di comunicarsi alla benzina.

Il discorso del professore Colombo fu vivamente applaudito, come pure l'esperimento dello Shepherd destò l'ammirazione degli spettatori.

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LA LOMBARDIA 2150

LA LUCE ELETTRICA

Rare volte abbiamo assistito ad una Conferenza tanto interessante ed istruttiva come quella che ci diede ieri, nel Ridotto della Scala, il simpaticissimo prof. G. Colombo, la quale Conferenza, oltre che dalla valentia del Conferenziere che, colla più grande semplicità sa volgarizzare o rendere alla portata di tutti le scienze più astruse, veniva resa efficace dalle esperienze da cui era accompagnata, sicchè la teoria era sempre confermata dalla pratica.

La sala del Ridotto, a cui era accorso un numeroso e scelto pubblico, era trasformata in un vero gabinetto di Negromante. La sala era immersa in una semi-oscurità — dall'alto del lampadario centrale scendevano due fili elettrici che andavano a cadere sul banco del Conferenziere, il quale banco era ingombro di macchine e macchinette elettriche, di ordigni d'ogni maniera fra cui tre o quattro *regolatori differenziali*, una piccola motrice elettrica ed una macchina da pompare — a destra del Conferenziere si vedevano due piccole macchine dinamo-elettriche.

L'ingresso era gratuito e gli onori della sala erano fatti dal conte Carlo Borromeo, vicepresidente della Società di Esplorazioni scientifiche, quella stessa che ebbe l'iniziativa di una serie di Conferenze scientifiche, di cui questa dell'illustre prof. Colombo è la prima.

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Dopo poche parole di introduzione il prof. Colombo attaccò subito l'argomento: *La illuminazione elettrica*, riassumendo brevemente la storia di tutti gli esperimenti fatti finora, a cominciare da quello fatto pel primo nel 1813 da Davy, e venendo giù fino allo ultime scoperte di Edison.

Parlò dei diversi pubblici esperimenti fatti a Milano, a cominciare dal gigantesco faro fatto inalzare in piazza del Duomo nel 1876, un faro della forza di 500 fiamme a gas, e venendo fino all'esperimento che in questi giorni si fa con tanto successo nella sala del Ridotto.

La luce elettrica che dapprima si presentava come un grande astro, poteva forse servire per illuminare grandi piazze e grandi strade, ma non poteva essere distribuita per gli usi comuni della vita. Bisognava trovare il modo di farla scendere dal suo piedestallo, per farla entrare nelle case, nei teatri e negli opifizi. Le prime esperienze fatte colle candele Jablockoff, esperienze che si fecero anche in Milano nel 1877 e precisamente in piazza del Duomo, dimostrarono che il problema doveva essere di possibile soluzione col sistema delle fiamme incandescenti.

Il prof. Colombo spiegò chiaramente questo sistema, lo reso accessibile a tutti con quella semplicità che forma di lui il più efficace Conferenziere. Ma cediamogli la parola senz'altro:

«Fra le difficoltà del sistema a incandescenza c'è questa: che bisogna impedire che il filo si consumi bruciando. Un filo di metallo brucierebbe presto all'aria libera; ma un filo di carbone si incenerirebbe assai più rapidamente. È dunque necessario di sottrarre il filo incandescente all'azione dell'ossigeno dell'aria, in una parola bisogna farlo arroventare nel vuoto. Così la pensarono infatti King e Lodiguyne; ma non poterono ottenere un vuoto perfetto e d'altronde non seppero preparar bene i loro carboni; cosicchè le loro lampade ebbero sempre il difetto che il carbone incandescente si consumava o si rompeva con una deplorevole frequenza.

« Risolvere il quesito dell'incandescenza era dunque ridotto a una questione di pazienza, di tenacità, di mezzi. Bisognava trovare un carbone che si potesse ridurre sottile quasi come un capello senza romperlo; un carbone così solido ed elastico che si potesse, malgrado la sua sottigliezza, sottoporlo a qualunque scossa senza spegnerlo; un carbone così omogeneo che la corrente lo traversasse senza trovare resistenze anormali. E nel medesimo tempo bisognava collocarlo entro un globo di vetro, in un ambiente perfettamente vuoto d'aria e capace di rimaner vuoto per un tempo indefinito. Ecco il problema che Edison si propose di risolvere, colla tenacia propria degli americani e valendosi di quella ricchezza di mezzi che egli può attingere a piene mani dalla fiducia illimitata dei suoi soci.

« Una strisciolina di carta carbonizzata, un filo di cotone possono rispondere allo scopo; ma son materie composte di fibre impastate insieme, e per quanto ben serrate, non possono a meno di offrire alla corrente dei salti, delle interruzioni sensibili. Le fibre naturali, invece, sono di gran lunga più omogenee; ed è appunto ad esse che Edison finì per dare la preferenza. Come tutti sanno le attuali lampade Edison son costituite da una fibra di bambù piegata in forma di un U rovesciato o di un ferro di cavallo. Questa fibra è carbonizzata con precauzioni speciali, poi i due capi son serrati in due morsetti che fan parte di due fili di platino; e il tutto è rinchiuso in un globo di vetro in cui si fa il vuoto con una pompa a mercurio. I fili di platino poi terminano separatamente a due anelli metallici isolati l'un dall'altro coi quali si fan comunicare due fili che si diramano dal circuito generale d'una macchina dinamo-elettrica.

« Eccovi un disegno — disse il professore accennando la lampada Edisson disegnata su di un quadro — in grandissima scala di una simile lampada. Come vedete la corrente derivata dal circuito generale passa attraverso alla fibra di bambù, la rende incandescente, poi ritorna per l'altro filo di diramazione al circuito generale. E così il circuito generale funziona come un gran fiume percorso da una larga e potente corrente, che forma un lungo circuito ritornando al luogo di partenza; di tratto in tratto dell'acqua è derivata dal tronco d'andata con un canale, anima una o più piccoli opifici, poi, esaurita così la sua forza, viene restituita di nuovo al gran fiume nel tronco di ritorno. E il fiume, continua il suo corso tranquillo, convogliando avanti le acque per supplire ad altre numerose derivazioni di simil genere.

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« Voi sapete che il sig. ing. Shephord, rappresentanto della Compagnia della luce Edison, ha intrapreso di illuminare per qualche tempo questa stessa sala, semplicemente coll'innestare delle lampade Edison ai 92 becchi da gas dei tre lampadarii. Giù in una corte vicina c'è una motrice a vapore, che muove una macchina dinamo-elettrica del sistema Edison, e che il signor Shepherd ha voluto gentilmente far agire oggi per me. Di là si diparte il circuito, da cui son derivati i fili che vanno alle singole lampade dei lampadarii, ed a quelle che egli ha messo a mia disposizione su questa tavola

« Vicino alla macchina c'è un regolatore per mezzo del quale si lancia a volontà la corrente nel circuito o la si interrompe; ed anche se ne regola la forza secondo il numero di lampade da tener accese e, sino ad un certo punto, secondo l'intensità di luce che si vuol ottenere. Io non ho che a trasmettere un segnale giù alla macchina, perchè tutte le lampade si accendano, come vedete, all'istante. (Infatti, in quell'istante, con grande meraviglia dell'uditorio, mentre gl'inservienti chiudevano ermeticamente le finestre, i tre lampadarj del Ridotto, s'illuminavano quasi per incanto). Benchè sia giorno, voi potrete facilmente apprezzare la dolcezza della luce, la sua perfetta immobilità e invariabilità, e la tinta pura e calda che essa possiede. È certo una luce magnifica.

« Ma vediamo con maggior quiete i particolari di questa lampada interessante. Eccone qui una alla portata della mia mano. Io la tengo in mano senza scottarmi, poichè è appena tiepida; la capovolgo, la agito, la scuoto, la butto sul tavolo, e non si rompe, ne si scompone; la immergo nell'acqua e seguita a star accesa. Questa lampada è munita di un vero rubinetto, come un rubinetto da gas. Giro il rubinetto e la lampada si spegne. Lo rigiro e si riaccende all'istante.

A questo punto del suo discorso il professore Colombo teneva in mano una lampada portatile Edison attaccata ad uno dei fili che, come più sopra abbiamo detto, pendevano dal lampadario centrale; e per dar forza alle sue parole il conferenziere girava e rigirava il rubinetto, accendendo e spegnendo istantaneamente la luminosa lampada.

Il prof. Colombo proseguì:

« Non è dunque questa lampada il vero equivalente di un becco da gas? Ma il gas mi scotta, se lo tocco; esplode e uccide, se sfuggendo inavvertito dai condotti e mescolandosi all'aria, viene per accidento in contatto con una flamma qualunque. Invece questa lampada è innocua. Io la inviluppo in un pannilino inzuppato di spirito, poi la rompo in frantumi, e lo spirito non s'accende.

« È difficile di trovar una lampada più semplice o più sicura. Quanto alla intensità della luce, essa non si scosta dall'intensità ordinaria di un becco di gas. Ve ne hanno della forza di 8 candele ossia di una lampada Carcel ad olio, o di un becco comune da gas; tali sono le 92 luci dei lampadari. Ve ne hanno invece di 16 candele, ossia della forza di un becco di gas che consumi 220 a 250 litri: eccovene una; è affatto simile è quella collocata come lampada stradale sull'angolo di via Filodrammatici (1).

« Se ne posson fare di solo 4 candele, anzi perfino di 2; poco più di un lumicino da notte; tutto dipende dalle proporzioni del filo di bambù. E infine, mettendo parecchi fili di bambù sotto uno stesso globo di vetro, si possono comporre a piacere lampade di 32, di 48 candele di forza, e così di seguito. Spingere più di così la suddivisione della luce sarebbe veramente difficile; e non sarebbe del resto nemmen necessario.

« Per l'illuminazione domestica voi comprendete benissimo che una lampada Edison è altrettanto comoda, anzi più comoda di un becco da gas; perchè la potete collocare comunque eretta, orizzontale, pendente, senza paura di accidenti e di incendii; ve ne potete servire come lampada da studio, con bracci snodati, o con fili flessibili, certo più flessibili dei tubi da gas, che perdono sempre e tramandano una puzza disaggradevole. Tutto sta che si formino società, le quali si propongano di distribuire questa luce a domicilio, e la forniscano a condizioni abbastanza miti per sostenere la concorrenza col gas; perchè è chiaro che non converrebbe a nessuno di fare un apposito impianto con motrice e macchina dinamo-elettrica per illuminare un appartamento e neppure una casa intera.

« Prima però di passare alla questione dell'impianto, permettetemi una breve digressione, per accennarvi ad altre lampade pure a incandescenza, di cui ho qui gli esemplari. Eccovi la lampada Swan, di cui si son già fatte alcune applicazioni in Inghilterra, per illuminazioni di convogli ferroviarii e per la illuminazione di alcune vie di Newcastle, patria dell'inventore. È costituita da una sottil treccia di cotone carbonizzata e piegata come vedete. Essa è molto semplice ed è assai ingegnoso e originale il modo col quale il globo di vetro si riunisce al globo portante i due bottoni d'attacco col circuito. Qui vedete la lampada di Lane-Fox, che ha adoperato un filo di gramigna in luogo della fibra di bambù di Edison. Infine questa è la lampada Maxim, il cui inventore ha preso per sè la prima idea di Edison di servirsi di una striscia di cartoncino carbonizzato, al quale ha dato la forma di un M.

« Qui la natura del corpo incandescente ha richiesto una certa grossezza, per cui queste lampade devono avere un'intensità maggiore delle precedenti; così ve ne hanno perfino della forza di 10 Carcel, ossia 80 candele circa. Capite benissimo che è sempre la stessa idea madre, applicata in modi poco diversi; ma, senza volermi pronunciare in modo assoluto, credo che nessuna delle lampade accennate presenti la semplicità e la solidità che caratterizzano la lampada Edison; e quanto a costo, avrei motivo di credere che la Edison è ancora quella che si può avere a miglior mercato, almeno per ora.

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« Queste lampade a incandescenza durano esse indefinitamente? No; ed è anzi questo l'unico piccolo punto nero dell'invenzione: tanto piccolo però, in fatto, che quasi non si può chiamarlo tale. Col tempo il carbone si assottiglia, talvolta, per così dire; il vetro si appanna, e la lampada diventa inservibile. Questo tempo, Edison lo calcola in media di 1000 ore d'illuminazione, anzi si diedero casi di 1200 a 1400 ore; altri per prudenza non calcolano che sopra 700-800 ore, e anche meno. Gli è come dire che la durata di una lampada, nel caso dell'illuminazione domestica, varierebbe, in ragione di 5 ore in media al giorno, fra 5 e 7 mesi. Dopo questo tempo, bisogna ricambiarla. Se queste lampade costassero molto caro, l'inconveniente non sarebbe piccolo. Ma le lampade Edison, per esempio, costano in America meno di 2 lire, brevetto non compreso; e si possono forse fabbricar in grande per un prezzo ancora minore.

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« Ed eccoci finalmente arrivati alla questione vitale, a quella del costo di questa simpatica luce. Se dobbiam credere ai dati che risultano dalle prove finora eseguite, il costo non dovrebbe esser grande. Vediamo di farcene un'idea. Per queste 92 lampade il signor Shepherd consuma circa 25 chilogrammi di carbon fossile all'ora, che è come dire L. 1 25. Fra macchinista, aiuto, olio, ecc., calcoliamo altre 5, o 6 lire per sera, quindi L. 1 all'ora. In tutto L. 2 25 all'ora, cioè meno di centesimi 2 1/2 per lampada e per ora. A questa spesa bisogna aggiungere la piccola quota pel ricambio delle lampade, e l'interesse e l'ammortamento della spesa d'impianto, che è naturalmente variabile secondo il numero delle lampade e la durata dell'illuminazione. Così, se si dovesse illuminare il nostro teatro della Scala, per esempio, sostituendo con altrettante lampade elettriche le 3000 e più fiamme da gas che esso richiede, bisognerebbe ripartire l'interesse e l'ammortamento solamente sopra 60 a 70 sere circa, cioè sopra 400 a 500 ore di illuminazione. Per l'illuminazione domestica, invece, si ripartirebbe, in ragione di 4-5 ore al giorno, sopra una media di 1500 ore all'anno.

« Per l'illuminazione stradale infine, si avrebbe a ripartire sopra circa 4000 ore, il che finirebbe per rendere assai tenue questa parte del costo complessivo all'ora. Questi calcoli è difficile di poterli fare ora, nell'incertezza di parecchi dati. Però ho voluto riportare una tabella che, in base ai dati più attendibili, fornisce il costo per lampada e per ora con diversi sistemi di illuminazione elettrica. Queste cifre possono essere discutibili una per una; ma almeno il loro rapporto non deve variar di molto. Voi vedete che il costo unitario per forza di Carcel cresce tanto più quanto più la luce è suddivisa; ma se anche consideriamo la lampada a incandescenza e la mettiamo a confronto con una lampada a gas equivalente, noi rileviamo dalla Tabella, che la prima apparirebbe ancora più economica, pur calcolando il gas a soli 30 centesimi il metro cubo.

« Notate bene che io non mi faccio garante di codeste cifre; tuttavia se anche il costo della luce Edison non fosse inferiore (parlo s'intende di grandi impianti) a quello del gas, non dovrebbe essere neppure notevolmente superiore.

« Ciò posto, come mai, si dirà, non vediamo noi già all'opera delle Società intraprenditrici, che installate in alcuni punti opportuni della città delle motrici colle relative macchine dinamo-elettriche e conducendo i fili sotto terra, si propongano di distribuire a condizioni eque la luce nelle case?

« Io risponderò che bisogna lasciar tempo al tempo. Si tratta di una invenzione recente, che appena appena comincia a far le sue prove nello stesso paese dove è nata. Anche il telefono, dopo aver sorpreso, abbagliato il pubblico ad un tratto, non fece quasi più parlar di sè per qualche tempo. Eppure anch'esso è già ormai entrato nelle abitudini, perfino da noi, al punto che adesso ci pare di esservi abituati sin dalla nascita. Lasciate che le lampade a incandescenza faccian la loro strada tranquillamente come il telefono. La questione è all'ordine del giorno dappertutto. In America, Edison stesso sta preparando l'illuminazione di tutto un distretto di New-York.

« La condotta è fatta per 15,000 lampade, fra pubbliche e private, che saranno illuminate allo stesso prezzo del gas. Le macchine dinamo-elettriche saranno le più potenti che si conoscano; poichè ciascuna di esse richiede 150 cavalli ed è capace, così ritiene l'inventore, di animare circa 1000 lampade da 16 candele, o 2000 da 8. La distribuzione deve farsi con sbarre piatte di rame messe con una sostanza isolante entro tubi di ferro, collocate sotto terra; e ad ogni tratto vi saranno le prese di corrente per le diramazioni disposte esattamente come le prese di gas. I privati tireranno in casa la loro derivazione mediante fili di rame inviluppati di cotone o di seta; e tanto la derivazione stessa, quanto le prese per le diramazioni sono munite di fili fusibili di sicurezza, in modo che il filo derivatore non possa mai arroventarsi per qualunque causa, fondendosi piuttosto prima il filo di sicurezza. La quantità di elettricità o di luce che si prende è misurata con apparecchi affatto simili, nell'aspetto esterno, ai misuratori da gas coi loro tre quadranti, perchè Edison ha voluto ad ogni costo disturbare il meno possibile le abitudini dei suoi concittadini, e quindi ha fatto in modo che tutto quanto si connette coll'uso della luce elettrica, abbia la stessa forma e lo stesso aspetto degli apparecchi analoghi dell'illuminazione a gas.

« Solamente il misuratore consiste, come si capisce bene, in un voltametro, una specie di apparecchio da galvano plastica, in cui si fa passare una data frazione di corrente; dalla quantità di rame che la corrente fa depositare si deduce la quantità di corrente consumata; e questa misura del rame si può

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fare e registrare da sè, sui quadranti, mediante una specie di bilancia automatica. Nel locale delle macchine trovasi un regolatore, col quale, in base alle indicazioni di un fotometro, si varia la forza della corrente induttrice secondo il bisogno. Tutto è preveduto, perchè questa grandiosa applicazione si faccia in condizioni tali da riuscire a un deciso successo.

« D'altra parte, ora più che mai, si può vagheggiare la realizzazione di quel grande ideale della meccanica moderna che è la distribuzione a domicilio dell'energia sotto tutte le forme: sotto la forma di forza, di calore, di luce. All'Esposizione universale di elettricità, tenuta l'anno scorso a Parigi, Deprez trasmetteva la corrente d'una macchina dinamo-elettrica a una ventina di apparecchi diversi, lampade ad arco voltaico e ad incandescenza, bagni galvanoplastici, macchine da cucire, seghe, torni e perfino a una macchina da stampa, che tirava dei numeri di un giornale d'elettricità.

« Gli è che ormai nulla si può dire veramente impossibile in quest'ordine di idee. La mia fede è inconcussa su questo punto; anzi se ho un timore, è di prevedere meno di quello che la scienza e lo spirito d'invenzione inaspettatamente potrebbero creare. Ma se anche mi ingannassi in queste viste lontane alle quali mi sento trascinato quasi mio malgrado, in questo son quasi certo di non ingannarmi: che prima di due o tre anni noi avremo la luce elettrica in casa. E il gas mi domandate? Il gas ha ancora davanti a sè, se lo vuole, un vasto campo d'azione. Esso ci darà il combustibile per l'economia domestica, se le vecchie compagnie, già ammortizzato da un pezzo, sapranno adattarsi alle nuove circostanze. Ci riscalderemo a gas e ci illumineremo a elettrico. »

E con queste parole il prof. Colombo chiuse la sua interessantissima conferenza, che fu salutata dagli applausi del pubblico il quale uscì di là meravigliato di quanto aveva veduto.

Dopo la conferenza del prof. Colombo, il signor James Sepherd si prestò a dare alquante spiegazioni ad alcuni che ne lo avevano richiesto, intorno all'applicazione delle lampade Edison. E a provare che ogni pericolo d'incendio è con esse rimosso, involse una lampada accesa con un panno inzuppato di benzina. Quindi con un martello ruppe il vetro. La luce istantaneamente si spense, senza aver tempo di comunicarsi alla benzina.

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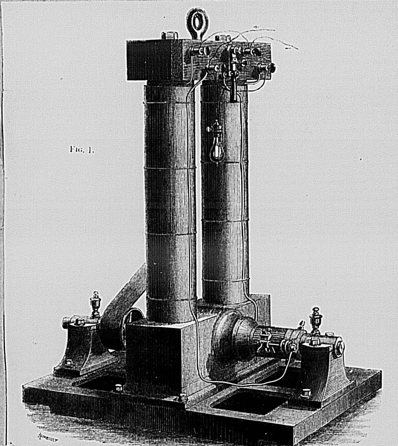
Fig. 1.



THE EDISON INSTALLATION AT THE CRYSTAL PALACE.

The Electrical Exhibition at the Crystal Palace is now approaching something like completeness or, at all events, its general appearance does not necessarily suggest to the mind of an ordinary visitor important and obvious omissions. The great nave and transepts are now lighted by electricity to the entire exclusion of gas, and each day shows a marked increase in the number of electric lights in the less important parts with a corresponding suppression of gas jets, a fact very typical of what is everywhere taking place in the outside world, and still more suggestive of what is inevitable in the immediate future.

Of all the electric lighting systems represented at the Crystal Palace, the most complete and important installation is that of Mr. Edison, or, more correctly speaking of the Edison Electric Light Company, and the whole of the exhibits of that enterprising body, whether it be the very striking and effective distribution of incandescence lamps in the Entertainment Court and Concert Room or in the splendidly worked out installation of the engines and generators at the principal garden entrance, is distinguished for its thoroughness and sound practical character, and we think it is not too much to say that this is acknowledged by competing exhibitors as much as by more disinterested visitors.

The Edison Company does not attempt to show at the Crystal Palace any electric arc lighting system, but confines itself exclusively to lighting by incandescence, a system which Mr. Edison has brought to great perfection and completeness, and which is, moreover, capable of far more general and extended application than any arc system. As this notice is intended rather to describe a particular installation than the system itself, we do not propose to describe in detail the lamps employed, as that highly interesting subject will be treated in due course in its proper place, and we have already referred in general terms to the construction of the Edison lamp, not only in our last article,° but on several previous occasions. We may, however, remind our readers that the Edison lamps are made in two sizes, the one having double the illuminating power of the other, its carbon filament being twice the length and offering twice the resistance to the passage of the electric current; of these two the "full lamp" has, under normal conditions, an illuminating power of sixteen candles, and the "half lamp" that of eight candles, the former having a resistance when in action of from 128 to 132 ohms, while that of the latter averages about 63 ohms, and they are always connected to the generator in parallel circuit, that is to say, each full lamp or pair of half lamps forms a bridge or derived circuit, connecting through its filament the two conductors, whether mains or branches, leading to the two terminals of the generator.

The lamps of the Edison installation at the Crystal Palace are about 840 in number, being made up partly of full lamps and partly of half lamps. It will, however, be more convenient to regard each pair of half lamps as if it were one full lamp, and upon this method of reckoning the number of full lights is about 680, distributed as follows:

Concert Room:		
Central chandelier	52	
Device (attached to organ) composing the name "Edison"	37	
Festoons of lights and other lamps...	197	
		286
Entertainment Court:		
Central chandelier	57	
Various other lamps, footlights, &c.	151	
		208
Domestic Court		83
Lights on stalls and pillars		80
Various lights:		
Engine room	15	
Illuminating the Kilway electric log	5	
Exhibit of Messrs. Phillips Brothers	3	
		23
		680

The Entertainment Court, with its magnificent and elaborate gilt chandelier, constructed by Messrs. Verity and Sons, to which are attached no less than 99 Edison lamps of both sizes, and in which court are fixed specimens of many of the electrical inventions of Mr. Edison, is undoubtedly one of the most attractive spots in the whole exhibition. The chandelier is in itself a remarkable specimen of elaborate ormolu work, representing a gigantic basket of flowers and foliage, the centre of each opalised glass flower consisting of an Edison lamp. The lamps on this chandelier are under the most complete control by the manipulation of one or more of four switch handles fixed at one corner of the room. With these switches the upper, middle, or lower zones of lamps can be ignited or extinguished at will, either in combination or separately, or if necessary, by the movement of one handle, all the lights on the chandelier can be lighted or extinguished together. In this room are also shown a considerable number of small chandeliers, lustres, bracket lights, and table lamps; there is also a dramatic stage illuminated by a long row of footlights worked on the same system, and a billiard table most effectively illuminated. Here also may be seen and examined specimens of the conductors devised by Mr. Edison for the canalisation of electric currents for illuminating purposes on a large scale, such as the lighting of a district from a central station, or for the transmission of electric energy to a distance.

The Concert Room, in which the special lectures will be given, as well as musical and other entertainments, is very effectively illuminated by a centre chandelier supporting 52 full lights, while around the hall, suspended between each pair of pillars, are festoons of lamps arranged very similarly to those which formed part of Mr. Swan's display at the Exhibition of Electricity at Paris, and by which the room set apart for the meetings of the International Congress was partly illuminated. In addition to these festoons there are a number of suspended lamps, as well as the illuminated device "Edison," the letters of which are composed of incandescence lamps. A large number of the stalls for the sale of fancy goods are illuminated by this system, being fitted with bracket lamps with opal shades similar to those which are about to be installed in the shops of the Holborn Viaduct, and there are a certain number of similar lamps and fittings attached to the iron pillars of that part of the Palace.

The type of generator employed in this very interesting installation is that known as the Edison "A" machine, which is illustrated in Fig. 1, and which has already been described in this journal,° and which consists of a longitudinally wound armature of low resistance revolving in a magnetic field produced by two long vertical cylindrical electro-magnets, their upper ends being united by a rectangular block of iron, while their lower ends terminate in massive polar extension pieces, whose opposed faces are bored out so as to form a hollow cylinder, within which the armature is rotated at a speed of about 1200 revolutions per minute, at which speed its electromotive force is 110 volts. Fig. 2 is a diagram of one of these machines, showing the way its connexions are made with respect to the four attachment screws numbered 1, 2, 3, and 4, which are fixed to the upper plate of the machine. It will be seen from this figure that the screws 1 and 4 are the

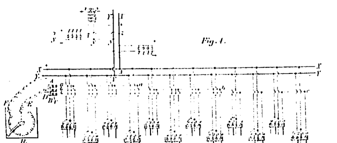


Fig. 4.

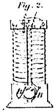


Fig. 2.

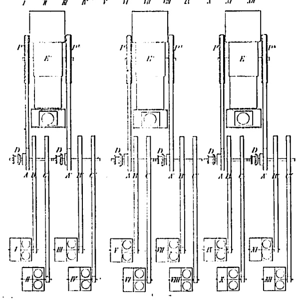


Fig. 3.

terminals of the magnet coils, while the screws 2 and 3 are connected to the collecting brushes, and may therefore be regarded as the terminals of the armature helix.

The electric currents for working all the Edison lamps in the building are supplied by twelve of these machines, which are erected in two parallel rows on the basement floor, and close to the principal garden entrance of the Palace. From the extensive nature of this machine installation, forming as it does two long rows of generators, worked by three engines through the intervention of six countershafts, as well as from the beautifully simple and well-arranged system for making the connexions and regulating the current to the work it has to do, it must be commended as the most thoroughly well-arranged, and well carried out mechanical installation in the Exhibition. We shall probably refer to this arrangement again in a subsequent notice, but the diagram, Fig. 3, will give some idea of the disposition of the engines, countershafts, and generators.

There are three 25 horse power semi-portable engines by Messrs. Robey and Co., of Lincoln; these are marked on the diagram E^{I}, E^{II}, and E^{III}, and on the crankshaft of each are fixed two driving wheels P^{1} and P^{2}, the one on one side of the engine and the other on the opposite side. Each of these pulleys drives, by means of a belt, a separate countershaft, which can in a moment be thrown into or out of action by a conical clutch or coupling C C^{1}, &c., actuated by a handwheel D working on a vertical axis. To each of these countershafts are keyed three pulleys, one smaller than the other two, which is driven by the engine belt and two larger pulleys B C, B^{1} C^{1}, &c., but equal to one another, each of which drives the belt by which it is connected to the pulley of one of the generators, which are shown in the diagram marked by Roman numerals I. to XII. The whole of this splendid installation on the ground floor has been carried out by Messrs. Hayward Tyler and Co., under the supervision of Mr. W. J. Hammer, one of Mr. Edison's assistants, and who has assisted Mr. E. H. Johnson throughout the whole of the work at the Crystal Palace. There is something very interesting and attractive in the perfect regularity, symmetry, and uniformity of the whole arrangement, and the high class finish and workmanship of all the component parts is worthy of the highest commendation.

The electrical arrangements, as well as the very simple and interesting method by which the strength of the currents is regulated, and by which the whole set of twelve machines is under complete control, are as thoroughly carried out as any other part of the system, and form a particularly interesting feature of the installation.

The arrangement of the conductors and regulators will be understood by reference to Fig. 4, in which the twelve generators are represented at the bottom of the diagram marked I., II., III., IV., &c., up to XII., the terminal screws of each machine (see Fig. 2) being numbered 1, 2, 3, and 4. Stretched along a board fixed in a vertical plane above and behind the machines are five copper wires, two of which for collecting the combined currents of all the twelve machines, shown in the diagram by thick lines at X X and Y Y, and transmitting them to the various circuits in distant parts of the Palace, while the three others marked *a a*, *b b*, and *c c*, are employed in connexion with the regulating apparatus to be presently described.

Referring first to the distribution of the currents generated by the machines and their transmission to the various lamp circuits, it will be seen that the arrangement adopted is of the simplest possible description. The two principal terminal screws of each machine (marked in the diagram 2 and 3), are connected respectively to the two wires Y and X in the manner shown in the diagram, so that the positive terminals of all the machines are connected with X X while all the negative terminals are in connexion with Y Y. From these two wires any number of branch mains X^{1} Y^{1} can be connected in a way precisely similar manner to that in which the machines were connected with them, and from these branch mains branches *x* and *y* can be led off similarly, and from these, smaller branches can again again be led. Across any of these pairs of conductors, so as to offer a passage for the current from the one conductor to the other, one or more lamps can be placed, and it is on this principle that all the Edison lights at the Crystal Palace are connected up, and it is the system adopted throughout all the installations of the Edison Company. In the diagram the position of lamps is indicated by the letters *l l l*, &c.

The method of regulation by which all the machines and lights are maintained under complete control is equally simple, although at first sight it may, by the repetition of parts necessary for the working of a dozen machines, appear a little complicated. The arrangement is, in principle, the same for all the machines, so that a description of one will suffice for all.

The principle upon which the regulation is effected is identical with that upon which the Swan lights at the Savoy Theatre are controlled, and which was described in these columns a fortnight ago,* that is to say, the main current is regulated by increasing or diminishing the intensity of the magnetic field of the machines by varying the strength of the current transmitted through the coils of the field magnets, and this is effected by throwing more or less resistance into the exciting circuit of the machines. In all Edison's generators the exciting helices of the electro-magnets form a shunt or derived circuit to the lamp circuit of the machine, and this arrangement in itself tends to regulate the current. The strength of this derived current is, however, increased or diminished by means of the variable resistance box or regulator shown at R in the diagram. This regulator consists of a table, below which are a number of resistance coils, consisting of iron wires stretched on skeleton bobbins, so as to have a free circulation of air around and between their convolutions. The quantity of this iron wire thrown into the circuit of the magnet coils is regulated by a pivotted lever attached to the centre of the top of the table, making contact in its rotation with a series of contact pieces corresponding to various lengths of the iron wire. The terminals of the regulator are connected respectively with the lower thick collecting wire Y, and with the branch piece D, which can be placed in metallic connexion with any or all of the three thin wires *a*, *b*, *c*, by the insertion at A, B, and C of contact pegs such as are used for resistance boxes.

Upon reference to the diagram it will be seen that the terminals of the magnet coils marked 1 and 4 on each machine are coupled in the following way: No. 1 is connected with the wire leading from No. 3 to the thick wire X, while No. 4 is connected to one of the three thin regulating wires. The object of employing three wires instead of one is to divide the twelve machines into three separate groups of four machines each, any of which groups can be thrown in or out of action by the insertion or removal of one or more of the contact pegs at A, B, and C. Thus each machine of the group marked I. to IV. is connected to the upper wire *a a*, and is controlled by the peg A; the next group from V. to VIII. being connected to *b b* is controlled by B; and the last group, IX. to XII., is connected to the lower wire *c c*, and is thrown into or out of action by the contact pin C. By this very beautiful arrangement it is possible to throw out of action any group of machines without perceptibly affecting the strength of the main current or the illuminating power of the lamps, and at the same time the expenditure of motive power, and therefore of the consumption of fuel, is proportioned to the work actually being done. In the same way the throwing of a large number of lamps out of circuit can instantly be compensated, and no variation in the intensity of those left in action can be detected.

In permanent installations an electromotive force indicator is provided at the central station, and an assistant, keeping his hand on the lever of the regulator, and his eye on the index of the indicator, can maintain the strength of the current within very narrow limits, notwithstanding what is happening to the lamps throughout the different circuits and their branches. At the Crystal Palace this is not considered necessary, and the assistant can, by observing the

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positive terminals of all the machines are connected with X X while all the negative terminals are in connexion with Y Y. From these two wires any number of branch mains X^1 Y^1 can be connected in a way precisely similar manner to that in which the machines were connected with them, and from these branch mains branches *x* and *y* can be led off similarly, and from these, smaller branches can again again be led. Across any of these pairs of conductors, so as to offer a passage for the current from the one conductor to the other, one or more lamps can be placed, and it is on this principle that all the Edison lights at the Crystal Palace are connected up, and it is the system adopted throughout all the installations of the Edison Company. In the diagram the position of lamps is indicated by the letters *l l l*, &c.

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responding increase of intensity in the magnetic fields in which their armatures are rotating, and each, by constituting currents of greater strength than before, compensates for the loss sustained by the stopping of the other contributing generators. Another secret of the success of the system is that the engines are not driven to the extreme limit of their power, so that there is plenty of margin to permit of their governors regulating their action to the work they are called upon at any moment to do. As a matter of fact the engines at the Crystal Palace installation are worked at close upon their nominal horse power, that is to say, at about 25 indicated horse power each; and experience has shown that about ten of the full size or sixteen-candle lamps can be worked to their full illuminating power per horse power expended.

The Edison machines, of the form illustrated in Fig. 1, are made in two sizes, that known as the "A" machine being capable of maintaining 75 full lamps or about 120 half lamps, and a machine of similar bulk called the "B" machine, but which is only applicable to the smaller or half lamps, of which it is capable of maintaining also 120 in circuit. The two machines differ, however, only in the internal resistance of the armature, and in the coupling up of the coils of the field magnets. Thus in the "A" machine the resistance of the armature is .14 of an ohm, while that of the coils of the field magnets, which are connected in series, is 60 ohms, each of the magnet coils having a resistance of 30 ohms; and this machine, when running at a speed of 1200 revolutions per minute, has an electromotive force of 110 volts. The "B" machine has an armature resistance of .035 of an ohm, while that of the magnet coils (which are exactly like those of the "A" machine) is only 15 ohms, each coil having a resistance of 30 ohms, but as they are connected in parallel circuit the resultant resistance is half instead of being double that of each coil, as in the "A" machine. The electromotive force of the "B" machine when driven at 1200 revolutions per minute is 55 volts. In both generators, however, the resistance of the magnetising coils is rather over 400 times that of the armature, a proportion which, in our opinion, might be increased with advantage, and the magnet coils form a shunt circuit to the lighting current.

The Edison installation at the Crystal Palace cannot fail to give to the Exhibition of 1882 a distinctive feature of interest, and one by which it will long be remembered; for, whether it be regarded from an electrical or from a mechanical point of view, or as an example of highly efficient and decorative illumination, it is quite unsurpassed by anything that has preceded it, and reflects the highest credit upon the Edison Electric Light Company and upon everybody who has been connected with the installation.

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THE ELECTRICIAN, MARCH 18, 1882.

Last Year's Electrical Patents.—Some idea of the extraordinary activity at present existing in the development of electrical science and the practical application of electricity to various useful and industrial purposes may be gathered from the following statistics compiled by Messrs. J. K. Fahie and Son, of the patent offices, High Holborn, London, and Nassau-street, Dublin:—During the year 1881 it appears that no less than 237 applications for British patents have been recorded in Her Majesty's Patent Office for inventions which may be classed under the heading of electricity. Of this grand total 135 emanate from British applicants, 52 from American citizens, and 50 from residents on the Continent (France, Germany, Belgium, &c.). Classifying the total number of 237 applications under special heads, it appears that 93 specifications have been lodged for improvements in electric arc lamps, 20 for improvements in incandescent electric lamps, 38 for magneto and dynamo machines, 32 for secondary batteries or electric accumulators, 26 for regulating, controlling, and measuring the electric current, 24 for miscellaneous appliances connected with electric lighting, and four for producing power and transmitting motion. Reviewing the names of the applicants for above patents it appears that the celebrated American inventor, Edison, stands highest on the list, having applied for no less than 24 patents for various electrical improvements. Messrs. Swan and Lane Fox each filed seven applications, mostly in connection with incandescent lighting, and M. Faure, of Paris, three for secondary batteries, while Mr. Maxim filed two, and Mr. Brush one for arc lighting apparatus. 2164

Electric Light in Milan.—The lighting of the Ridotto della Scala by Edison incandescent lamps continues (says *La Lombardia*) to be greatly admired. Mr. Shepherd, the representative of the Edison Company in Milan, has lately demonstrated the adaptability of the system to street lighting in the Via Filodrammatici.

THE DAILY TELEGRAPH,

MARCH 29, 188[illegible]

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THE ELECTRIC LIGHTING CONTRACT and MAINTENANCE COMPANY (Limited).—Incorporated under the Companies Acts, 1862 to 1880. Capital £2,003,000, in 200,000 "A" shares of £10 each, with power to increase, and 300 "B" shares of £10 each, fully paid up. The first issue will be 100,000 of the "A" shares and the 300 "B" shares. The "A" shares will be entitled to a preferential dividend of 6 per cent. per annum, and the "B" shares will be entitled to one-third of the surplus profits, after the payment of the dividend of 6 per cent. on the "A" shares. 10s. will be payable on application and 30s. on allotment. The balance will be called up as required in sums not exceeding £1, and at intervals of not less than three months, of which two months' notice will be given, but in no case will any further call be made before the 1st September, and then only if the progress of the company's business should render it necessary. It is not the intention of the directors to call up more than £5 per share of the present issue.

DIRECTORS.

Martin Ridley Smith, Esq. (Messrs. Smith, Payne, and Smiths), 1, Lombard-street, E.C.
Albert G. Sandeman, Esq. (Messrs. Geo. G. Sandeman, Sons, and Co.), 20, St. Swithin's-lane, E.C.
Stewart Pixley, Esq. (Messrs. Pixley and Abell), 27, Old Broad-street, E.C.
Walter H. Maudslay, Esq., M.I.C.E. (Messrs. Maudslay, Sons, and Field), Lambeth.
R. Raynsford Jackson, Esq. (Chairman of the National Telephone Company, Limited).
Colonel Gouraud (Director of the United Telephone Company, Limited).
J. C. F. Lee, Esq., M.I.M.E., A.I.C.E., Ravenhead, Beckenham, Kent.
Stamford S. Young, Esq. (Director of the South African Loan, Mortgage, and Mercantile Agency, Limited).
Gerard Norman, Esq., 19, Chester-square, S.W.

Bankers—Messrs. Smith, Payne, and Smiths.
Solicitors—Messrs. Dawes and Sons, 9, Angel-court, Throgmorton-street, E.C.
Brokers—Messrs. Steer, Lawford, and Cuerton, 3, Drapers'-gardens, Throgmorton-street, E.C.
Secretary (pro tem.)—F. R. Grigg.
Temporary Offices—6, Lombard-street, E.C.

PROSPECTUS.

This company has been established to act as an independent medium between the public and the various manufacturing and patentee companies to supply the electric light by contract, sale, lease, or rental to towns, public buildings, factories, docks, railways, &c., and for domestic use; and also for the supply of electricity as a motive power for all purposes to which it may be applicable, and to assist financially in such objects.

The essential principle upon which this company proposes to act, and upon which the directors have based their expectations of success, is their perfect freedom to adopt all or any of the numerous patents for lighting now or hereafter to be brought before the public. They will have no object in working any one system in preference to another, but will be guided in their selections solely by considerations of convenience, cost, and suitability.

Could not the three members be allowed to come to vote, and could not some three of the Irish members now in the House be held as hostages, and when the division was over be kept in the custody of the Sergeant-at-Arms until the three suspects turned up again at Kilmainham? ("Hear, hear," and laughter.) Already the Government had allowed some suspects out to attend the funeral of relatives; why not let out others to attend the funeral of the Constitution? (Laughter.)

Mr. GLADSTONE: I understood that the gentlemen of the political section to which the hon. member for Sligo belongs had intended to arraign the general conduct of the Government on this occasion. From the course of his observations, and the silence of those who sit around him, I conceive I must have been misinformed. If there had been a disposition to arraign the general conduct of the Government, I should have desired to take my part in its defence, and to state what I think about the course the hon. gentleman and his friends take with respect to the present state of Ireland. That not being so, I will simply—as they are evidently waiting for a reply from the Government on this particular subject—rely upon them that that, and no other, is the subject of debate to-night. (Irish cries of "No, no.") Then I must decline to proceed now, if there is to be any other subject of discussion. If it is the intention to assail the general policy of the Government I will sit down for the present. (The right hon. gentleman resumed his seat amidst cheers from the Liberal Benches.)

Mr. CALLAN hoped his hon. friends would not be led into a trap. The people of Ireland wished for a clear and distinct declaration from the Government on this subject, and nothing should be done to prevent that being given.

Mr GLADSTONE: Then, I will proceed. The hon. member for Sligo concluded his speech by an imputation which, I need not say, is in the highest degree offensive. The imputation was this—and it is for gentlemen who hear me to judge whether it is offensive or not—that any reasons or pleas which the Government could advance for declining to accede to this request were mere shows and pretences, and that the whole and sole reason why the request is refused is in order that the Government may avoid the disadvantage of having three additional votes recorded against them. ("Hear, hear" from Irish members.) It is impossible to assign to any body of men conduct more disgraceful. (Hear, hear.) Consequently, if to assign disgraceful conduct be offensive, I must say that the speech of the hon. gentleman and his imputations, conveyed with a coolness and assumption of certainty which treated the matter as beyond all doubt and question, were offensive in the highest degree. (Cheers.) I do not intend to reply in a similar spirit. I do not intend to use any words myself in dealing with this comparatively limited, though rather delicate and somewhat important question, which can hurt or wound anybody. The hon. gentleman said that under the plea of making use of the resources of civilisation we were indulging the instincts of barbarism. ("Hear, hear," from Irish members.) That is a much fairer charge, and it is one perfectly intelligible. It certainly would tempt me to widen the field of this debate, and to inquire what are the instincts of barbarism that are now being principally stimulated and indulged in in Ireland, and who are the persons by whom these instincts are deliberately stimulated?—(Mr. HEALY: The Chief Secretary)—who, in fact, are the persons who carry rapine, murder, and mutilation into houses, into the dwellings of the families of the innocent people of Ireland, for the offence of paying rent? (Cheers.) That is the inquiry which I should have been

THE DAILY TELEGRAPH, FRIDAY, MARCH 31, 1882.

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COMMON COUNCIL.

A meeting of the Court was held yesterday, at the Guildhall, the Lord Mayor in the chair.

Mr. Deputy SAUNDERS, in answer to a question, said that a committee of the Metropolitan Board of Works had recommended a contribution of £20,000 towards a sum necessary for improvements at Hyde Park-corner. Whether that amount was part of an estimated outlay of £28,000 he could not say.

Mr. FELTON said that the electric lighting in No. 1 District (the Brush light) had been supplied at about the same price as gas; in No. 2 (the Lontin light) at about twice the cost of gas; and in No. 3 (the Siemens light) at about 3½ the cost of gas. On the last occasion he stated that the Brush Company had supplied the electric lighting for less money than the cost of gas. About £40, he believed, was the difference. Since then the company had sent in a contract which would bring up the price to about £120 more than gas. With regard to a better light being obtained by the use of gas on an improved system, as in Fleet-street and elsewhere, he might say that the cost of the gas in Fleet-street was over four times the cost of the Brush system of electric lighting. (Hear, hear.)

The report of the Epping Forest Committee, recommending that the City Seal should be affixed to an agreement with the trustees of the late Earl of Mornington for the exchange of the pleasure grounds formerly belonging to Wanstead House, and containing 184 acres, for certain pieces of forest land containing fifty acres, and asking the Court to provide the sum of £8,000 out of the City of London Grain Duty for equality of exchange, was unanimously agreed to.

The Court adjourned at five minutes to one.

SOCIÉTÉ FRANÇAISE DE PHYSIQUE

44, rue de Rennes, 44

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SÉANCE DE PAQUES

MERCREDI 12 AVRIL 1882

A 8 HEURES DU SOIR

Monsieur Batchelor Charles

MEMBRE DE LA SOCIÉTÉ FRANÇAISE DE PHYSIQUE

Cette carte rigoureusement personnelle doit être remise en entrant

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THE DAILY NEWS, SATURDAY, APRIL 8, 1882.

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THE ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.

It is as an electric light show that this Exhibition is attracting the public in such large numbers, and it is in this respect that it compares most favourably with that held in Paris last year. There were, perhaps, a greater number and a greater variety of lamps in Paris; but the Palais de l'Industrie is not to be compared with the Crystal Palace as a place for the display of the electric light. The graceful contour of the building, the light and shade of the luxuriant foliage, the sparkling fountains, and the brilliant courts eminently adapt it for the captivating exhibition that is now being held there. There are certain peeps to be obtained, especially one in the Alhambra Court, which for exquisite effect are not to be surpassed by any known theatrical scene or by any picture of Oriental splendour. It is not so much a *mélange* of electric lamps or a blaze of light as was seen in Paris, but an exhibition of electric lighting—in fact, an illustration of the way in which the Crystal Palace, its approaches, and its courts can be illuminated by modern science. With Paris fresh in the memory, one feels disappointed on first visiting the building at night, but on asking one of the principal exhibitors why he did not show more lamps, his reply was, "I am not exhibiting lamps, I am showing how the Palace should be lit." Indeed it is not so much an exhibition of lamps as an exhibition of systems of illumination. Broadly there are two systems on trial, that by incandescence and that by arc. The difference between them is this:—The arc light produces its effect through combustion, the incandescent light through non-combustion, the one means destruction or waste of matter, the other means permanence. Both systems owe their light to the intense heat produced by the flow of electricity through poor conductors. In the arc light the poor conductor is hot air, but air so hot that it raises the particles of carbon in it to the highest temperature known, and therefore to an intensely white heat rivalling that of the sun; in the incandescent light the poor conductor is a fine filament of carbon *in vacuo*, in which the temperature is so toned down that it has no destructive influence on the material, and the light is so subdued that it compares rather with gas than the sun. The light of the arc lamp is unbearable to the naked eye; that of incandescence can be regulated at will to bear the inspection of the weakest sight. The opinion appears to be well-nigh unanimous that the arc light is only available for external purposes, and that the only possible internal and domestic light is that of incandescence. Indeed, some go so far as to say that such rapid progress is being made with the incandescent lamp that it is only a question of time to see it supplant the arc light for both purposes. Its advantages are so manifest—it consumes no material, it vitiates no air, it requires no attention, it can be fixed anywhere, its light is soft, steady and uniform; it is so readily controlled; in fact, if electricity be brought to our doors, no one would forego the comfort and pleasure of these gems of light, even though their cost be double that of gas. There are, therefore, two questions to solve besides the production of a lamp, viz., the proper distribution of electricity throughout a town, and its economy relative to gas.

Mr. Edison is far and away in advance of all rivals in the solution of these problems. His exhibition is the wonder of the show, and his representative is certainly the prince of all showmen. There is but one Edison, and Johnson is his prophet. One feels after an hour with Mr. Johnson that there is nothing left to be done, that one's gas shares must be sold at once, that there is only one system, and that is Edison's, and that every question has been solved. He takes you to the lower regions, and shows how three steam engines are so connected with the electric works, so that the failure of one or even two engines does not put out the lights; how twelve dynamo machines produce electricity in such a way that the sudden stoppage of even four of them does not perceptibly affect the brilliancy of the light; how two thick conductors distribute the electricity throughout the whole building, so that lamps can be put in and out without affecting each other or wasting any energy. He shows how the electric pressure can be regulated so that the lamps can be raised and lowered at will. In fact, he shows in every essential respect how electricity can do what gas can do. He then takes you to the Concert-room, where 200 lamps illuminate a very large area, and where they can be put in and out without difficulty or trouble. You are then lead to the Entertainment Court, where art aids the electrician, and where you are admitted into the secret of every detail; and after a visit to a suite of rooms belonging to the Domestic Lighting Company, elegantly furnished by different firms, and to the bazaar under them, you feel that domestic illumination by electricity is an accomplished fact; and when you ask for some shares in the Edison Lighting Company you are told that the necessary millions were subscribed in one afternoon, and that the shares cannot be had for love or money. Nothing can be more complete than the Edison system. The Swan lamp is very pretty. The Picture Gallery and the Furniture Court are very effectively illuminated by it. There is an office in the south nave near the crystal fountain where the light may be always inspected. The difference between the Swan and Edison lamp is very trifling. Each has a filament of carbon hermetically sealed in a glass globe from which the air has been abstracted, and they vary only in size and shape. Some prefer the graceful curl of the Swan, others like the simple horseshoe of Edison. Some say that the one is brighter than the other, but this simply depends on the quantity of electricity flowing, and either can be made to shine with the dulness of a hot poker, or with the brightness of an arc, but with this brightness rests the life of the lamp. At an intensity of 16 candles the Edison lamp will last 1,000 hours; at 30 candles it will last, perhaps, not many more minutes. The difference between the Swan and the Edison exhibit is this—that the Swan shows a lamp and nothing more. His electricity is produced by a Siemens or a Bürgin machine, and there is nothing special or marked in the way his connections are made; but the Edison system is original, novel, and complete in every detail. Incandescent lamps are shown by the Anglo-American Brush Company, who illuminate the Alhambra Court very beautifully with the Lane-Fox lamp—a carbon thread enclosed in an egg-shaped globe of white opaque glass, by the Electric Light and Generator Company, who have a magnificent glass "electrolier" manufactured by Defries and Son, and fitted up with Maxim lamps and by the British Electric Light Company, who also use Lane-Fox lamps by which they illuminate a very fine display of Powell's glass in the Egyptian Court.

All [illegible] incandescent lamps are [illegible] same principle, viz., a filament of carbon inserted in a glass globe from which all the air has been extracted. Their differences are differences in minutiæ and manufacture. One uses natural fibre such as the bamboo, another uses parchmentised paper, another uses cotton thread. The light they give depends on the length and thickness of the carbon hair, and on the electricity that flows through it. Some give a light of two candles, others of 100 candles. Some are made for street lighting, others for domestic use. The suite of chambers fitted up by the Domestic Electric Lighting Company shows how easy it is to supply a modern mansion with this charming light, and the display in the Alhambra Court proves how magnificently it aids art in developing details and enhancing colour.

One most noticeable feature is the artistic excellence displayed—especially by Messrs. Verity—in beautifying hangings, pendants, and supports. Nature in all her beauty clothes the crystal lamps with her petals and her leaves, and we see the brilliant rays striking into prominence graceful branches and drooping stems. If the electric light has done nothing more it has shown us how we can illuminate our rooms with taste and elegance. But it has done a great deal more—it gives us a light which produces neither smoke nor smell, it drops no grease or wax, it does not spoil our picture frames, nor damage our paint, it does not fire our hangings, it gently warms our rooms without consuming our air, and it aids ventilation by removing that which principally vitiates the air.

We illustrate in the accompanying figure (Fig. 1) samples of bamboos brought from South America, Japan, &c., by Mr. Edison's agents, for the purpose of testing them in order to ascertain which afforded the best material for the carbons for his incandescent lamps. Each bamboo was exhaustively tested, till at length a certain one was selected for use. The following are the names of the canes illustrated in the figure:—1, Hauchikee, from Japan; 2, Nebuchitakee, from Japan; 3, Shiho Jikee, from Japan; 4, Sugar Cane, from Venezuela; 5, Horteichikee, from Japan; 6, Kuraichikee, from Japan; 7, Matakee, from Japan; 8, Brazilian, from Para, Brazil; 9, Hauchikee, from Japan; 10, Shikakuakikee, from Japan; 11, Mountain Bamboo, from Japan; 12, Shikakuakikee, from Japan; 13, Brazilian, from Para, Brazil; 14, Shikakuakikee, from Japan; 15, Japanese, from Yokohama, Japan; 16, Torachikee, from Japan; 17, Chinese, from Hong Kong, China.

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When a selection had been made, the method of manufacture was carefully considered and every detail arranged, so that the manufactured article should be produced at the lowest cost. Fig. 2 shows the processes of manufacture. The bamboo is taken of proper length 1, and split into two parts 2, 2. Each of these parts is divided into three smaller parts, which are pared down to separate the pithy from the stronger fibrous texture, shown in 3, 4, 5, 6, and 7. When No. 7 stage is arrived at the strip is cut in the shape shown in 8, the thicker ends being so left to obtain good contact, or shaped as in No. 10, when carbons for the smaller lamps are required. Each strip in No. 10 will make two carbons, as in No. 11. The next stage to Nos. 8 and 11 is the carbonisation of the fibre. The process of carbonisation being of a somewhat delicate nature, care has to be taken, or the previous work might easily be spoiled. The filament shaped as in Nos. 9 and 12 is laid in a groove cut in a metal case—the metal generally used is nickel—which groove is covered to render it air-tight, and so prevent combustion. The filament so protected is then placed in the furnace and raised to the temperature required.

In Fig. 3 are shown the various changes undergone by the glass globe from its earliest stage, until it is completed, and the carbon fixed inside. The processes are very simple. The lamp consists primarily of two parts, one the central stem of glass, as shown in Fig. 3, No. 11, into which are fused the conducting wires, to the ends of which the carbon filament is fixed, as in Nos. 12, 13, 14, the other the globe proper, Nos. 1 and 2. The lamp is exhausted from the top, and, when exhausted, sealed, to prevent entrance of air. One conducting wire is in contact with the screw at the lowermost point of the lamp, whilst the other is in electric contact with a brass ring around the rim of what we may call the stem of the lamp. No. 4 shows how the exhausting tube No. 3 is fixed to the globe No. 2, whilst Nos. 5, 6, 7, 8, 9, 10, 11, show the processes gone through in order to form two of the inner stems. Cases containing the above samples are displayed at the Crystal Palace Exhibition amongst Mr. Edison's other exhibits.

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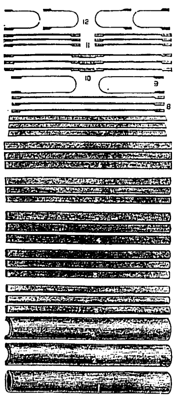


FIG. 2
PROCESSES IN THE MANUFACTURE OF THE CARBONS

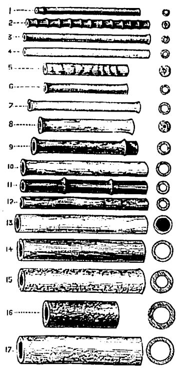
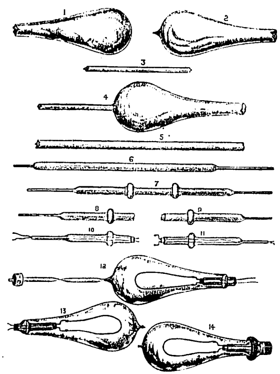


FIG. 1
SAMPLES OF BAMBOO



PROCESSES IN THE MANUFACTURE OF THE LAMP

FIG. 3.

Mr. Edison.—The second number of *Celebrities of the Day*, a monthly magazine of contemporary biography, contains an account of Thomas Alva Edison. According to this authority, the American inventor is of Dutch descent, some of his family having emigrated from Holland to the United States in 1730. His father is still living at the ripe age of three score and ten, and is to all appearance likely to count as many years as his father and grandfather, who attained respectively the ages of 102 and 103. Our readers will be surprised to learn that Mr. Edison is extremely deaf. He has two children, who are named, the one Dot and the other Dash, but of which sex our biographer does not reveal.

The Edison Light in Berlin.—It is announced that the National Bank of Germany has just concluded the preliminaries of a contract with the agents of Mr. Edison for illuminating certain public buildings with his incandescent lamps.

Beilage des Berliner Börsen-Courier

Donnerstag, 13. April 1882.

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—?— In der Druckerei des „Berliner Börsen-Courier" (W. Bürenstein), Zimmerstraße 40/41, hat gestern zum ersten Male in Berlin die neue elektrische Glühlampe von Edison ihre Fähigkeiten erprobt. Sechzig Flammen, für welche die Elektricität von derselben Dampfmaschine erzeugt worden ist, deren Kraft diese Zeilen druckt, haben zur Herstellung der vorliegenden Zeitungs-Nummer geleuchtet. Abgesehen von den Redactions-Räumlichkeiten, in welchen die elektrische Beleuchtung eingeführt wird, wollen wir hier von der Wirkung des elektrischen Lichtes in den Fabrikräumen sprechen. An jedem der Setzkästen der Setzer des „Börsen-Courier" ist ein kleiner, wenige Zoll langer luftleerer Glasballon angebracht, in welchem der dünne, hufeisenförmige Draht glüht. Absolute Luftleere ist nicht herzustellen, aber bis auf — ein Millionstel Raum-Inhalt sind die kleinen Ballons luftleer. Die Wendung eines kleinen Hahnes läßt den Draht sofort ausglühen und unterbricht den elektrischen Strom. An jedem Setzkasten brannte eine Flamme von acht Kerzen-Stärke, während über den Metteurtischen und im Correctoren-Zimmer Flammen von sechszehn Kerzenstärke angebracht sind. Das Licht ist nicht grell und scharf, wie das derjenigen elektrischen Beleuchtung, die man bisher kennen gelernt hat, und es wirft auch nicht jenen scharfen Schatten, es hat nicht jenen, etwas geisterhaften Farbenton, durch den bisher das elektrische Licht, das man in Berlin kennen lernte, etwas unheimlich und unbehaglich wirkt, es ist ein warmes und sehr starkes Licht. Während bisher die Gasflammen in unseren geräumigen Setzer-Localitäten Abends eine drückende Hitze und dicke Luft erzeugten, ist bei der elektrischen Beleuchtung von Hitze nichts zu spüren. Die Setzer hatten bisher unmittelbar neben ihrem Kopfe die heißen Gasflammen, während bei der elektrischen Lampe die kleine Glasumhüllung fast ganz kühl bleibt. Wie sich die Preisverhältnisse des Gases zur Elektricität stellen, vermögen wir nach unserer eigenen Erfahrung natürlich noch nicht anzugeben; allem Anscheine nach stellt sich indeß das stärkere Licht eher billiger als theurer als das schwächere Gaslicht.

Die Einrichtung — wie gesagt, die erste in Berlin — ist von denjenigen Ingenieuren bewirkt worden, welche die Edison'sche Glühlampe in Berlin einbürgern wollen. Herr Ingenieur Rathenau hat die oberste Leitung der technischen Anlagen geführt, welche zwei amerikanische Ingenieure selbst bewirkten. Die maschinellen Einrichtungen rühren theilweise von der Berlin-Anhaltischen Maschinenbau-Actiengesellschaft her. Bekanntlich hat die „Nationalbank für Deutschland" den Vertrieb jenes Edison'schen Patents für Deutschland übernommen, und unter ihrer Aegide ist diese erste Installation des elektrischen Lichts in Berlin erfolgt. Wir werden noch Gelegenheit haben, von dem interessanten Versuch, der ja das allseitige öffentliche Interesse erregt und es in der That verdient, weiter zu sprechen. Schon gestern Abend wurde die neue Einrichtung von einigen technisch interessirten Persönlichkeiten, die von der Neueinrichtung Kunde erhalten hatten, in Augenschein genommen. Unser Setzersaal ist der erste elektrisch erleuchtete Fabrikraum in Berlin, und es hat sich bei der ersten Erprobung diese Beleuchtung jedenfalls glänzend bewährt.

DAILY NEWS, WEDNESDAY, APRIL 12, 1882.

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THE EDISON ELECTRIC LIGHT.

Another and an important stage in the progress of electric lighting was entered upon last night at Mr. Edison's offices on the Holborn Viaduct, when the energetic inventor's agents in this country—Mr. Johnson and Mr. Hammer—gave a demonstration of his system of producing, distributing, and measuring electricity. Mr. Edison is somewhat late in the field of practical illumination, for the reason that he was unwilling to come before the scientific and the general public before he had solved every difficulty which he could foresee, and was prepared to meet his competitors, the gas companies, on their own ground. This he claims to be now able to do, and the exhibition of last night was intended at once as a triumph and as a challenge. So important is this country considered to be as a means of revenue, that Mr. Edison has chosen to produce his system in London rather than in New York, though it is understood that the priority merely represents the time required for the manufacture of the plant necessary to enable the light to be made in America also. The light is not merely an illuminant, but a system, for Mr. Edison has invented his dynamo-machine and every detail connected with the supply; and his patents, which have been acquired by a company for use in Great Britain, are forty-two in number. The idea governing the system is that upon which the supply of gas is based—namely, the production of the lighting agent at a central station, its distribution by means of wires to houses, &c., over a given area, complete control over each lamp without effect on the other lamps, and the measurement of the electricity supplied; and as gas may be applied to the purpose of lighting or of heat, or of motive power, at the option of the consumer, so it is contended that electricity may, on Edison's method, be similarly employed. It is further maintained that the electricity is equally diffused over the whole of the area covered, so that at any point of the wires a lamp may be attached which shall be of the same illuminating power as any other lamp upon the circuit. The area of illumination embraced last night included Mr Edison's offices, the Holborn-viaduct from Newgate-street to Holborn-circus, the Imperial Hotel, the Holborn-viaduct Hotel, the buffet of Messrs. Spiers and Pond, the London, Chatham, and Dover Railway Station, and a number of shops and buildings upon the viaduct. The City Temple has also latterly been lighted on Edison's system, and in connection with this it may be mentioned that a record of the temperature shows a remarkable difference in favour of the coolness of electric lighting as compared with gas. If a record could also have been made of the condition of the atmosphere under the two methods relatively, the contrast would probably have been still more striking.

Of the quality of Mr. Edison's light those who have witnessed the exhibition of it at the Crystal Palace and those who may observe it on the Holborn Viaduct can judge for themselves. It is a white light, produced by an incandescent carbon filament, of an elongated horse-shoe shape, in a small pear-shaped lamp of clear glass, and it burns in a vacuum. Each lamp is of 16-candle power. Into the respective merits of this light and of other incandescent lights we have no intention of entering, any more than we have of debating whether other inventors have or have not trenched upon the domain which Mr. Edison regards as exclusively his own. This latter question is one which, to all appearance, will have to be decided by the Law Courts, and to them it may be left. The questions for the public are—the practicability of domestic lighting by means of electricity; the safety of such lighting to person and property; and the cost. These are questions which can only be settled by the process of *solvitur in ambulando*. Mr. Johnson met them last night in an interesting exposition of the Edison system, partly by experiment, partly by a statement which, he said, was based upon careful calculations. As to the practicability, there was no doubt whatever that the lights over the area described were supplied from the central station in the basement of the offices, and there was also equal certainty that the lamps could be turned off or on. The ingenious contrivances by means of which an equal diffusion of current was obtained were also explained and shown in action. As to safety to person, besides the difficulty of getting at the wires, the fact of each lamp receiving only its proper share of the whole supply seems to remove all risk of the calcining of an unfortunate householder by a new form of parlour lighting. The danger of fire is guarded against by a fusing lead plug being placed in connection with each wire supplying a lamp, so that in case of an undue amount of heat being locally manifested, the current is at once cut off. In connection with this branch of the subject, it is significant that the insurance companies seem tranquil in regard to the risk, and that the premises in Holborn, which stand in the relation of gasworks to the electric system, and which also contain many hundreds of lamps, are insured at an exceptionally low rate. The question of cost depends at present upon statement and calculation. Mr. Johnson's attention was called to two points—first, that owing to the supply of gas being a monopoly, gas is manufactured in an unnecessarily costly manner, and is sold at an unnecessarily high rate; secondly, that a gas company could afford—so it was put—to give away the gas, depending upon the sale of residuals for a profit. His reply to the first objection was that Mr. Edison based his defiance of the gas companies on a calculation, not of the price at which gas was sold, but of the price at which it could be made. Upon the second point, he remarked that the sale of electricity for other purposes than lighting would be a source of revenue equivalent to the sale of gas residuals, and that the electric light could also be given for nothing. Time and competition will show what these things mean; but if there is even a possibility of rival gas and electric companies begging the people to take their light as a gift, the outlook of the consumer is brighter than one would have supposed. Without being so sanguine as to look forward very confidently to such a consummation, we may add a shrewd remark by Mr. Johnson as bearing upon the conflict—namely, that an increase of out-put diminishes the proportionate cost, so that as electricity advances, it becomes cheaper; as the use of gas diminishes, the cost of producing it becomes greater.

These are a few of the matters suggested by the long-delayed entrance of Mr. Edison into the arena. Without prejudging the case, which is here merely presented, we may, at any rate, make the reflection that electric lighting is indeed a remarkable illustration of the energy of our times, for not only are there various representatives of electricity defying gas to deadly combat, but they are also preparing to do battle amongst themselves for the survival of the fittest.

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PROGRESS OF ELECTRIC ILLUMINATION.

Another step in the introduction of electric lighting for public purposes was marked last night by the exhibition of a complete system of production and distribution of electricity, and its application for street and house lighting over a definite area. This has been accomplished for the first time in this country by the agents of Mr. Edison, who received a numerous party of gentlemen interested in the subject at their central station, No. 57, Holborn-viaduct, in the lower basement of which the electric currents are generated by which 2,360 16-candle power incandescent lights are maintained, and these lights now supply the lamps by which the viaduct is at present illuminated between Holborn-circus and St. Sepulchre's, and also many of the shops and large buildings along the line, including the great Holborn hotel of Spiers and Pond. Mr. E. H. Johnson, Mr. Edison's London engineer and representative, and Mr. W. J. Hammer, his assistant, received their visitors, about fifty in number, and gave them the most ample information on all the details of the subject. Mr. Edison's inventions bearing on electrical light are mostly known in England through his lamps, and the beautiful forms of electric chandeliers in which they have been successfully used by Messrs. Verity and Co. They include, however, in addition to the various important points connected with the transport and distribution of electricity for all purposes whatever, his very powerful dynamo machines, by which large quantities of electricity of low "potential" or intensity are generated; and every portion of the great area occupied by electric lighting, and its subsidiary processes is thus entirely covered by the contrivances which his genius has devised for them. On entering the great room on the ground-floor of the establishment, the visitors plunged at once into a blaze of nearly colourless light, of great illuminating power, certainly, as none of it was absorbed by semi-transparent media, but which produced no disagreeable impression on the eye. The temperature of the apartment was rather warm, but as the light was produced from 170 centres, near many of which everyone was standing, the calorific effect was not much to be wondered at. The Edison lamp is, as well known, constructed on the "incandescent" principle, and so differs materially from the street electric lamps hitherto seen in the streets of London, which are on the "arc" principle. In the incandescent lamp the electric current is made to traverse an exceedingly fine film or wire, formed of some carbonaceous material. This being a bad conductor of electricity, and the resistance offered by the film to the passage of the current being increased by the smallness of the section of the film, the electricity becomes converted into its equivalent of heat, under which the wire is raised to a high temperature, and thus becomes luminous. For illumination on this principle to be effective the resistance to the current must be large, and its potential low. The amount of the resistance, in fact, determines the quantity of electricity which is converted into light. In Edison's lamps, to employ the units used by electricians, the resistance is expressed by 110 "volts" and the potential by a few "ohms." On the walls of the apartment the mode of working the lights for a whole town was shown. For this purpose pairs of parallel wires at the same level were stretched between fixed supports. There were several rows of these pairs of wires arranged at different heights from the ground, and all were connected up, so as to join the conducting wire forming the terminals of the dynamo machine. The terminals connected with the ends of the fine carbon film in each lamp were attached to stout wires, and these were made fast to the line of parallel wires. Each lamp hung transversely to the wires, and the current passed on continuously from lamp to lamp throughout the entire circuit used. In this room also was shown Mr. Edison's "safety catch," a useful little instrument in principle not unlike the fusible plug of a steam-boiler. It is just possible, under exceptional circumstances, that a fine conducting wire may become heated, and so occasion fire. To prevent that the safety catch contains a leaden plug which is made to form part of the circuit. When a great heat is developed, this leaden portion of the circuit is the first to fuse, and on its fusing the circuit is broken and the lights go out. Attention is thus directed to the state of the wire. The defect is corrected, and a new leaden plug is inserted, and the whole system may now be lighted up safely. One of these safety catches is to be used with every lamp on a circuit. The power employed in the production of the current is a fine Porter-Allen (Philadelphia) engine of 125 horse-power indicated; and this, like every other part of the producing system, is supplied in duplicate to provide against accidental break-downs. It was working last night at 350 revolutions per minute, a high speed being desirable. Edison's dynamo-machine is a study in itself. It is of colossal dimensions, and is said to be much more powerful than either the Gramme or the Siemens machine. In principle its operation consists in the rapid rotation of a bar of copper between the poles of a powerful electro magnet. The electricity thus generated in the copper is taken up by an instrument called a "brush," which presses against it, and draws off the electricity as fast as it is generated, to be passed thence by suitable conductors into the street main. It is to be observed as regards the safety of the Edison lamp that the potential of the current, which, as already observed, is low, is not increased, as in the arc lights, by an increase of the number of lights in the circuit. It is, in fact, altogether independent of the number of lamps, and Mr. Johnson showed how harmless were the physiological effects of the current circulating through the whole electrical main for the viaduct by intercepting it, and making it pass through his body. Several of the visitors followed his example without hesitation, and all concurred in saying there was no appreciable sensation whatever. Mr. Johnson's explanations extended to every part of the subject. He said it had been Mr. Edison's aim to complete a system under which electricity could be transported and supplied to a house by a street main, like gas or water, and the quantity consumed, whether for lighting, for power, or for any other purpose, accurately measured by means of a meter, like gas. That was the problem which Mr. Edison proposed to himself just three years ago. He soon arrived at the conclusion that to attain that end he must first have a conductor of very high resistance. Before doing that, however, he raised the platinum lamp from its natural standard of three-candle power to 32-candle power by artificial means. The difficulty of getting the platinum into a workable form stopped him in that direction, and led him into that of producing the pure carbon film, which, being perfected and enclosed in a vacuum, evolved the beautiful light which they now saw. As regards the question of cost, he stated that that would be practically solved within the next two or three months, but all the conditions were favourable for a satisfactory issue of the question in the interests of electric lighting. As regards safety, it was mentioned by Mr. Johnson that when the electric light was first brought out it was brought to their notice through the Press that the Fire Companies, or some of them, meant to double their rates for buildings in which it was used. They took no action in the matter, but the Phœnix Company made an independent investigation by Mr. Heaphy, C.E., and were satisfied of the high degree of safety which buildings would enjoy with electric light; and at the present moment the Edison Central Station was insured with the Phœnix Company at a rate which was lower than that given by any Company for any risk. Mr. Johnson mentioned many other interesting matters on various points of the subject, which the lateness of the hour at which the exhibition concluded makes it impossible to reproduce now. There are 200 street-lamps alight on the Viaduct; the London, Chatham, and Dover Railway Company have 160 in their Holborn station, and the Holborn Viaduct Hotel and Messrs. Spiers, Pond, and Co.'s buffets are brilliantly illuminated by it. Each street-lamp has two Edisons in its lantern, burning beside the ordinary gas, with which it may thus be easily compared.

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THE GOVERNMENT ELECTRIC LIGHTING BILL.

The following correspondence has passed between the Board of Trade and the Corporation of Manchester on the subject of the above Bill :—

"Town-hall, Manchester, April 3.

"Sir,—I have to express, on behalf of the Corporation, their thanks for being furnished, in confidence, with a copy of the Draft Electric Lighting Bill, which has been carefully considered by them.

"The Corporation would in the first instance advert to their recent memorial to the President of the Board of Trade, and express their hope that the Bill may be so amended as to authorize municipal corporations to supply electricity for public and private purposes within their respective districts of supply of gas. Subject to this observation, it is submitted that, in accordance with the Report of the Select Committee of 1879, every local authority should be invested with the exclusive right within its own jurisdiction of supplying electricity for public and private purposes, and that the area of supply should in every case be co-extensive with such jurisdiction.

"The report of the Select Committee on lighting by electricity, 1879, indicates that such preference should be given to the municipal authority. Mr. Farrer stated (see Evidence, 1,659)—'I would give every facility to a Corporation to supply electric light. I think that, on the whole, the tendency from what has happened in the case of gas and water, is to vest these things in the municipal body as representing the public.' The Bill, however, places on the same footing, in relation to a provisional order, all municipal corporations, local boards, companies, and persons, and in this respect fails to give effect to the recommendations of the report of 1879.

"There is nothing on the face of the Bill to prevent several private electric companies from at once promoting provisional orders for the supply of electric lighting in the City of Manchester, whereby they would acquire the powers for breaking up streets conferred by the 'Gas Clauses Acts.'

"The Corporation, while urging that the powers of the Bill should in the first instance be confined, as already stated, to municipal corporations and local authorities, are willing that means should be provided, as suggested in the Report of 1879, for preventing undue inaction in the use of such powers.

"The Corporation respectfully urge that the true position of electrical patentees is to make contracts with local bodies, and that it is on grounds of public policy undesirable that the patentees should be invested with the extensive powers proposed by the Bill. The Corporation would further urge that the electric lighting clauses in the 'Manchester Corporation Bill' now before Parliament, should be allowed to proceed. The Corporation respectfully request that the opportunity may be afforded them of stating in greater detail the views which they now indicate in general terms. I am, &c.,

"N. H. TALBOT, Deputy Town Clerk.

"H. G. Calcraft, Esq., Assistant-Secretary, Railway Department, Board of Trade, London, S.W."

"Board of Trade (Railway Department), London, S.W., April 11.

"Sir,—I am directed by the Board of Trade to acknowledge the receipt of your letter of the 3d inst. on the subject of the Electric Lighting Bill which has just been introduced, and to request you to lay the following reply before the Manchester Corporation.

"The Bill has been framed in accordance with the recommendations of the select committee of 1879 to which you refer.

"The report of that committee does not recommend that an exclusive right to supply electricity should be given to municipal authorities, but that 'municipal authorities should have power to give facilities to companies or private individuals to conduct experiments,' and that, 'when the progress of invention brings a demand for facilities to transmit electricity as a source of power and light from a common centre, for manufacturing and domestic purposes, it may be expedient to give to the municipal authority a preference during a limited period to control the distribution and use of the electric light; and, failing their acceptance of such a preference, that any monopoly given to a private company should be restricted to the short period required to remunerate them for the undertaking, with a reversionary right in the municipal authority to purchase the plant and machinery on easy terms.'

"The Bill proceeds strictly on these lines. It enables the Board of Trade to grant either to a municipal body or to a private company a licence for the use of electricity for five years (with a power of renewal at the end of that time); but in the event of a grant to a private company no such licence will be granted without the consent of the local authority. The local authority will, therefore, always be able either to obtain such a licence itself or to control and impose conditions on the grant of any such licence to a private company.

"In the present state of knowledge, it seems probable that this provision will in general be sufficient. The great object at the present moment is to facilitate and encourage the making of experiments, rather than to establish permanent schemes for lighting a whole town, and these experiments can best be made by limited supplies from numerous centres and within small areas.

"But to provide for any cases in which larger schemes and greater outlay may be necessary, or in which the local authority may arbitrarily or negligently refuse, either to supply electricity itself or to allow others to supply it, the Bill contains a provision enabling either these local authorities or companies, by means of a provisional order, to be confirmed by Parliament, to obtain powers to supply electricity which may last for any period fixed by the order, but with the condition in terms of the recommendation of the select committee that after a period of seven years the municipal authority may purchase the plant and machinery at their then value, and thus make themselves masters of the subsequent supply.

"It is true that in this case no express preference is given to the municipal authority, but there can be little doubt, in the event of competing schemes being introduced by the Corporation of Manchester and by private companies, that both Parliament and the Board of Trade would be disposed to give the preference to the Corporation.

"It is the intention of the President of the Board of Trade, if the Bill should be read a second time, to refer it to a strong committee, in order that the various points it raises may be then discussed with the assistance both of municipal authorities and of those who are interested in supplying electric light. In preparing a Bill on a subject of so much novelty, and dealing with matters of such an experimental character, he is anxious that its provisions should be most carefully discussed, criticised, and, where necessary, amended. This will probably meet the suggestion of the Corporation that they should state their views in greater detail. At the same time, the President will be glad to receive and consider any criticisms on the Bill as introduced which the Corporation may wish to offer.

"With regard to the suggestion that municipal authorities should have the exclusive supply of the electric light, and to the clauses in the Manchester Bill (27 and 28) which appear to have that object, it is to be observed that any proposal for such a monopoly ought to be accompanied by stringent provisions for universal supply. It is obvious that the present state of electrical science does not admit of such provisions, and one of the most important objects of present legislation ought to be to prevent such a monopoly—whether in the hands of companies or of corporations—as will interfere with progress. It is further to be observed that if, with the aid of such committee as I have referred to, a satisfactory general scheme can be introduced, it is extremely undesirable that Parliament should give its consent to special local legislation inconsistent with that scheme.

"I am, &c., "T. H. FARRER."

"N. H. Talbot, Esq., Deputy Town Clerk, Town Hall, Manchester."

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THE ELECTRICIAN, APRIL 15, 1882.

EDISON'S SYSTEM OF INCANDESCENT LIGHTING.

On Tuesday night an exhibition of Edison's system of lighting by incandescence was given at the offices of the Edison Electric Light Company, No. 57, Holborn-viaduct, E.C. The Company have now completed the fixing of their lamps on the Viaduct, and in the various shops, &c., in the immediate neighbourhood, and although these lights have been running for the last night or so, the proceedings of Tuesday night may be said to have been the opening ceremony.

Those who had been invited for the occasion were received by Mr. Johnson, manager of the company, who, prior to explaining the different varieties of lamp, conductors, meters, &c., proceeded to say a few words on Mr. Edison and his inventions.

Mr. Johnson said that Edison had recognised from the very first that the problem of electric lighting could only be solved when the public could be supplied with electricity through a meter, at the same price as gas. This could not be done by placing a steam engine and dynamo in every house, but by having a large central generating station, from which the electricity could be conveyed by conductors to the houses where it was required, and there used as wanted, a meter registering the exact quantity consumed, in precisely the same way as was at present done by gas meters. He alluded to the innocent remark made by Mr. Edison to an American interviewer, and the consequent misunderstandings that had arisen as to what Mr. Edison was really doing. After this remark the world did nothing but talk of Mr. Edison, and he became famous. Soon after, as the expected light did not come forth, the world began to sneer at him, and for two years he was almost lost to sight. All this time he was perfecting his system, with the results that would presently be shown, and which London had the honour of seeing practically in operation for the first time. As to the question of cost, Edison said that electricity was cheaper than gas, because he had satisfied himself that he could get more light from one pound of coal by using electricity than he could by using gas. The question was, could electricity be distributed through the streets at a low enough cost to enable it to compete with gas? Now, that was a question of the cost of the copper necessary for the conductors, and the cost of the copper for the conductors hinged upon another question, viz.: How economical was a lamp in converting electricity into light? Now, that was determined by the resistance of the carbon; and this, therefore, determined the size of the conductors, and the cost of them. Edison could compete with gas when lighting an area of a mile square, but not over that limit, on account of the cost of the copper conductors. The manufacture of electricity on a large scale could alone determine the unit of the main plant in the statement of cost. He would show them below a dynamo-machine maintaining 1,000 lamps at 16 candle-power each, reaching from Hatton-garden to the Old Bailey. The whole details of the cost of this installation would be taken into account in estimating the relative cost of lighting by electricity and by gas, and such well-known electricians as Dr. Hopkinson and Dr. Fleming would carry out the calculations. In answer to a suggestion that he had not taken into account the fact that gas companies, having a practical monopoly, could charge a high price, and that this price was much above the actual cost of the gas, Mr. Johnson said that Edison had based his estimate of the relative cost of the two means of lighting upon the cost price, and not the actual price charged to consumers. With reference to the residual products which went to swell the gas companies' dividends, he would say that the Edison Company supplied electricity not for lighting only but for the production of power also, and this latter he looked upon as quite equivalent to the residuals of the gas companies. He might say that if people would utilise the electricity for power they could give it away for lighting purposes. Referring to Mr. Edison again, he said that it was this aspect of the question that he was working out during his disappearance before alluded to. People then said that the whole thing was a fraud; however, he reappeared again, and others with him. During his disappearance he had worked the problem out, and found that the products of electricity could be sold so as to enable it to compete with gas. It was a well-known fact that as you increased your output you decreased the cost of production, and, therefore, as you decreased the output of gas you increased its cost. As to the question of danger from fire, he (Mr. Johnson) about a year ago wrote to the *New York Tribune*, stating that if the electric light installations were continued as they had then been established, there would be numerous fires. This happened as he had predicted, and the New York Board of Underwriters had to stop the putting in of electric light plant until they could ascertain what were the necessary conditions of safety. They went to Edison, and he turned them over to him, Mr. Johnson. He showed them the plug, which was fitted in every room lit by the Edison system, and which acted as a safety plug. This plug stepped into the path of the current as it went to each lamp, and acted in a precisely analogous manner to the fusible plug in a boiler, as he would show them presently. He then alluded to the recent rise in their rates that had been made by some of the insurance companies on the exhibits at the Crystal Palace. They, the Edison Company, had heard nothing of it, except through the newspapers, so they took the initiative, and went to the insurance companies; they then found that the companies had let them alone. This was a sufficient comment on the safety of their system. He might add, however, that the insurance on their present building in Holborn-viaduct was at the lowest rate that was charged on any similar class of building in London. It might now be asked who were they? In reply he would say that originally they had come over to make a practical demonstration of their system. Then came the Crystal Palace Exhibition, to which they at once turned their attention, and he thought it would be admitted that they had not done badly there. Then came the question of the formation of a company to take over Edison's patents—there were only forty-two of them—to ascertain their validity, and work them. He thought that the board of that company was a sufficient guarantee as to its status.

Then, as regards the electrical side of the question, they had retained the services of two such able electricians as Dr. Hopkinson and Dr. Fleming. Being asked as to how far the heat from the Edison lamp would affect the temperature of a room, Mr. Johnson replied that perhaps as good an answer as any he could give would be to give the average temperatures recorded in Dr. Parker's Temple on the Viaduct during the last four Sundays, lighted as it was by 170 Edison lamps. The figures had been furnished to him by the janitor of the Temple, and were as follow:—Average temperature when lighted by gas at this time of year, over 80deg.; average temperature for last four Sundays when lighted by Edison lamps, 58, 61, 65, and 52deg. In answer to a further question as to the danger to life accruing from the use of the electric current, Mr. Johnson stated that, according to their system, there was absolutely no danger at all. The danger arose from the manner in which some engineers connected up the lamps. Connecting up in series, as had been done by some, was not the proper way for incandescent lamps; it was like sticking up a row of targets one behind the other, and then expecting your projectile to go through the last as fast as through the first. This was an impossibility. But if the lamps were connected up in multiple arc, as in the Edison system, the current was divided equally between all the lamps. (Mr. Johnson here explained the multiple arc system.) When they were down in the engine room he would show them how, when the dynamo was supplying a current sufficient to keep 1,000 lamps at 16 candle-power, he would lay hold of the conductors leading from that machine, and pass the whole of this enormous current through his body without receiving the slightest injury. Perhaps that would impress them with the absolute safety of their system. He then invited those present to accompany him down stairs to inspect the machines and lamps, first cautioning them to leave their watches upstairs, to avoid their possible magnetisation and consequent stoppage when in the proximity of the dynamos.

The way in which the lamps on the Viaduct were controlled from the central office was then explained, the visitors adjourning to the street, whilst the lamps in the various circuits were alternately extinguished and lighted again, by turning the different switches in the office. After practically illustrating the action of the fusible plug, and showing the motors used, Mr. Johnson led the way to the engine room, where the two large dynamos are placed, one only being required to work all the lamps at present in use, the other being kept in readiness in case of a breakdown. Mr. Johnson, according to promise, passed all the current from one of the machines through his body, and seemed none the worse for it. He then illustrated the rapidity with which, in case one machine broke down, the other could be got to work. Before leaving the engine room Mr. Johnson paid a high compliment to Mr. Hammer, his assistant, to whose energy, he said, he had been greatly indebted. The big dynamo and engine were illustrated and described in a recent issue, and it is not, therefore, necessary to refer to it further here.

The Edison lamps are now in daily use on the Viaduct, in a great majority of the shops on the Viaduct, in Dr. Parker's City Temple, and Spiers and Pond's Viaduct Hotel, and the light given by them is most satisfactory. We shall hope to refer to the details of the system at greater length in a future issue.

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THE MORNING POST, WEDNESDAY, APRIL 12, 1882.

THE ILLUMINATION OF STREETS AND HOUSES BY ELECTRICITY.

The Edison Electric Light Company invited last evening a number of scientific gentlemen and others interested in the progress of electric lighting to witness the illumination of the Holborn-viaduct and adjacent streets and houses by means of their incandescent lamps. The electrician to the company, Mr. E. H. Johnson, gave an elaborate explanation of the methods employed not only to generate the electric current, but also to diffuse and supply it throughout the district, and illustrated his remarks by a variety of experiments. The station from which the district is supplied is at 57, Holborn-viaduct, in the basement of which two immense dynamo machines are employed to generate sufficient electricity to feed 2,360 incandescent lamps of 16 candle power. The smallest of these machines weighs 22 tons, and supplies 1,000 lamps; while the larger one supplies 1,300 lamps. Insulated wires are laid in the convenient subways which pass along the viaduct, serving as mains from whence numerous submains or branch wires, insulated and enclosed in tubes, convey the current to the various buildings which are lighted by the company. These wires are fitted with a patent fusible plug, which prevents any risk or danger of fire which might, by any possibility, occur through an accidental excess of electricity. The prevention of accidents has been a great point of study by Mr. Edison in the various experiments which he has made with the view to perfecting his system for incandescent lighting, and the absolute immunity from danger was severely but satisfactorily tested by those who assisted at the experiments conducted upon the occasion. The wires which conveyed the electrical energy necessary to light the countless lamps at the central station were freely grasped by many of those present without any unpleasant results, and it was explained that this was due to the low pressure which Mr. Edison has been enabled to employ in his system of lighting. The lights exhibited illustrated in the most practical manner the immense variety of uses to which the incandescent light is applicable. Chandeliers and brackets, reading lamps, and table lamps in abundance, fitted with all kinds of globes and shades, demonstrated the perfect simplicity and practical usefulness for all purposes of the incandescent light which Mr. Edison claims to have been the first to introduce to public notice. A meter by which the current could be supplied to shops, public buildings, and private houses was also exhibited, and the method by which the amount used could be registered was lucidly explained. The Holborn-viaduct Station already supplies some 200 street lamps besides the 60 in the London, Chatham, and Dover Railway Station, 175 in Dr. Parker's City Temple, and other lamps in the Imperial Hotel and private warehouses. The whole of these lights are under the most complete control, and can be turned on or off as simply and as easily as an ordinary gas light—more easily indeed, inasmuch as the application of an external light is unnecessary. From numerous questions which were addressed to Mr. Johnson, it appeared that the completeness, simplicity, and immunity from risk which distinguish the Edisonian system have been tested by every conceivable method, and the sole problem which awaits elucidation is the question of cost. This, it appears, depends so entirely upon a variety of exterior circumstances that it cannot be satisfactorily solved, except by the test of actual use, but the company have every reason to believe, from the calculations they have made, that when applied to large areas the cost will be lower than that of gas.

THE STANDARD, THURSDAY, APRIL 13, 1882.

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THE EDISON SYSTEM OF ELECTRIC LIGHTING.

The inauguration in London of the system of street and house lighting which has been elaborated by Mr. Edison having been made, the period has arrived when, having before us an actual example, some definite account can be rendered and foundation for fair criticism obtained. What is it that he has attempted to do? The Edison "system" is the tangible reply to the question he set himself to solve in the way he individually thought best—"Is it possible to employ electricity as an illuminating agent, not merely as an accessory to gas or as useful in exceptional cases, but as a practical and reliable means of illumination, safe in use, readily adapted, certain in action, and accurately measurable?" This is a wider problem than the production of a useful electric light, or the subdivision of an electric current into a few lights; the difference, in fact, being the difference between producing an electric light and a system of electric lighting.

The typical Edison "system" is the lighting of a square mile of town area from a central station by means of mains radiating from that centre and so connected with branches and cross-lines that the whole of the network of circuit wires is, so to speak, permeated by electricity, in a way that over the whole area an equal supply of current for all the lights is obtainable. Each "system" is composed of twelve "units," and each unit is supplied by an Edison generator, consisting of engine and dynamo machine combined upon one bed-plate, and capable of maintaining a thousand lights of 16-candle power each—the corresponding light to the ordinary gas jet. Mr. Edison elected to follow this mode of supplying small incandescent lights, because he considered that the public did not commonly want more light for ordinary purposes; and because, also, he believes there should be a more equable distribution of illumination by a number of small lights than by one or a few large ones. In adopting the incandescent form of electric light he contends that, contrary to the arc system, it is not less, but more efficient in proportion as it is applied on larger and larger scales. He assumes that for a system of electric lighting to be safely and widely adopted by the public there must be certain specific conditions to be complied with. Each light must be independent of others, and must be a convenient unit of small candle-power. Each consumer must have absolute control of the lights on his premises; and the engineer at the central station must know at each instant the state of every lamp on his circuit and be able to govern them all.

Mr. Edison starts, then, with a convenient unit for his light—namely, 16 candles. In practice there may be two "half lights" of 8-candle power each; or there may be "double lights" of 32-candle power; but in speaking of the number of lights maintained mention is made as for all being lights of 16-candles. The lamp is a glass bulb, in which is placed a long loop of bamboo fibre, of horse-shoe shape, very fine in section and of great electrical resistance, namely, about 220 ohms when cold, and 140 ohms when hot. After exhaustion to a high vacuum the lamp is doubly sealed to maintain that vacuum. The carbon fibre is rendered incandescent by the passage of the electric current through it. The chief feature in this kind of lighting is that every lamp forms a bridge between two mains, one carbon of each lamp being connected with the one main, and the other carbon of each lamp with the other main conveying the current through the circuit. Every lamp is thus independent of the rest, because if any lamp be broken the current is at once divided amongst the remainder, and any increase in the number of lamps lowers the resistance the current experiences in passing through the lamps from main to main. The armature of the Edison dynamo machine has a very low resistance, and in order to obtain this the bobbin of copper wire employed in other machines has been abandoned, and the core is formed of iron plates, around which is built up a number of copper bars of great thickness. From this it results that the resistance of the dynamo-machine is only a small fraction of the electrical resistance of the lamp. The resistance of the mains is also very small, and accordingly the obstacle to the passage of electricity across from one main to the other is almost wholly concentrated in the lamps. By this arrangement in cases of lamps being added or withdrawn, as the electrical resistance to the current is decreased or increased, a corresponding influence is exerted upon the engine and machines. It will readily be perceived thus that the greater the number of lights upon a circuit the larger is the number which can be turned on or turned off without affecting the rest. In priva te establishments there would be various numbers of electric lights placed as gas jets are in positions convenient for use; but of these many would be only occasionally employed. An electric current meter therefore is desirable in order that consumers may pay for what only they have consumed. Now, it is known that 1000 cubic feet of gas gives, roughly, 3000 candles' light. Mr. Edison takes that quantity of electricity which, passed through the lamps, gives that amount of light, and he calls it arbitrarily 1000 units; and the electricity used is therefore measured in "thousandths." In order to reckon the quantity used, the current is passed through a "meter," consisting of two zinc plates immersed in a solution of sulphate of zinc on the one part, and a copper coil on the other part; and on the principle of electrolysis, one zinc plate diminishes in weight and the other increases in weight. The increase in weight is deemed exactly proportional to the quantity of electricity which has flowed through, and in order to reckon the quantity chargeable to the consumer the zinc plates are at intervals weighed and the means between the loss of one plate and the gain of the other accurately taken.

By the use of currents of low electric pressure and the interposition of the lamps between the mains, anything like serious danger to persons handling exposed parts of the electric circuit is avoided; for the tension of the current being only 110 volts, and the resistance of the human body very great—several thousand ohms—whilst the resistance of the lamp circuit is very small, only an insignificant portion of the current can traverse the body even if the bare hands are placed on the principal conductors.

The adaptability of the incandescent bulb-lights to ordinary fittings has been abundantly shown, and we need not dwell on that point, after the variety of ingenious brackets and electroliers which have been produced by the former makers of gas fittings.

As to certainty of operation in the supply of electricity, each dynamo is provided with a switch by which it can be cut out of circuit or put into circuit. The breakdown of a dynamo-machine in any installation can thus be very quickly provided for. In every installation the dynamos would be driven in groups by separate engines, and by proper counter-shafts and belts it would be easy, in the case of the break-down of the engine, to drive any group by the other engine power, or when the engine and dynamo constitute one combined machine the electric current from one could be shunted by conducting wires from one set of feeders to others. No ordinary accident would thus be the cause of any general extinction of lights.

Having seen thus how the Edison system vindicates itself upon all its points, we have to deal with what has actually been done in that installation which has given rise especially to the present article. The area now lighted—that of the Holborn-viaduct, from Newgate-street to Holborn-circus, represents one "unit" or one-twelfth of a square-mile system; it being understood that the working plant is based upon the circumstances and conditions existing in New York City. The Central Station is at the Edison Company's offices, at No. 57, and thence the mains and branches are carried in protecting pipes under ground to ninety street lamps, the four entrances to the London, Chatham, and Dover Railway Station, the front portions of two large hotels, and to the lights of about twenty shops. In this total of lights there are several sections, each of which can be turned on or off from the central station. The appearance of these ninety street lamps for the past few nights has been a little unintelligible, for the ordinary gas jet was kept burning between two Edison lights. The reason of the lighted gas jet was that the Company, intending to show the cutting off of the sections of light on the occasion of their inaugural entertainment, made this provision against any portion of the street being left in momentary darkness. Hereafter the incandescent lamps will do their own work, and the gas jets will be extinguished. The reason of there being two incandescent lights in each street lamp is that the City authorities do not permit the taking down of the gas service; and consequently as one incandescent light cannot be put in the centre with its proper reflector, one electric light without any reflector has had to be put on each side of the gas burner, which occupies the central position.

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The power of each of these electric lights is 32 candles; consequently each street lamp gives out an illumination of 64 candles. A comparison of these street lamps, however, with the single 32-candle power lamps at the entrances to the railway station will show that if single Edison lights of this power could have been put properly and centrally in the street lamps, the illuminating power would have been nearly or quite as good as it is at present. The service of electricity is provided for in the Central Station by two Edison 1000-light machines, with steam-engine and dynamo combined. The piston-rod of the engine works direct upon the shaft of the armature of the dynamo machine, and runs at the rate of 350 revolutions per minute. The power developed by the steam-engine in ordinary working is 125 h.p., but it can be raised to 200 h.p. The strength of the electric current is 950 ampères but notwithstanding this enormous force the two great copper conductors can be handled by both hands without the slightest inconvenience or perception of anything at all approaching to a shock. Only one of these huge generating machines is employed for the service of the lighting, the second engine being held in reserve. In a full installation of a "system" there would of course be twelve engines, and no spare one, as the twelve would always have reserve of power enough in themselves to supply the break down of any one of the set. The total lights now maintained on Holborn Viaduct, we believe, is over 1200; and the general condition of the incandescence in these lamps is excellent.

It is understood that the present installation will be made to give exact details of cost of plant, maintenance of lighting service, and all other details, necessary to enable an absolute comparison of the actual cost of the Edison system to be made in regard to the comparative lighting of the same district by gas. In two months a report to this end is to be made by Dr. Hopkinson and Dr. Fleming, and published to the world.

THE DAILY TELEGRAPH, WEDNESDAY, APRIL 12, 1882.

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ELECTRIC LIGHTING IN LONDON.

"Gentlemen, leave your watches behind you" was the mysterious caution with which Mr. Johnson invited his guests, last evening, to descend to the region where Mr. Edison's giant dynamos were at work, on the Holborn Viaduct. The fear was not, it seems, that some light-fingered person would make free with the valuables, but that the tremendous magnetic power of the machines for producing the electric current would permanently magnetise the steel springs and render the watches useless. The warning was not unnecessary. The Edison Company has now inaugurated in Holborn a system for general domestic and street electric lighting, and they are using for this object two of the largest dynamo machines in existence, driven by engines of over 100-horse power, and capable of supplying upwards of 2,000 incandescent lamps, and incidentally capable of magnetising any number of watch springs. The importance of last night's demonstration on the Holborn Viaduct was that it was the first instance in this or any other country in which the electric light has been produced, distributed, and measured out, precisely in the same way as gas is supplied to the public. Some 2,000 incandescent lamps were at work, on Mr. Edison's premises, at the Railway Restaurant, in the shops on the Viaduct, and in the street lamps—all served by the single powerful machine we have mentioned. From the same centre wires might conveniently be extended half a mile in any direction, and laid on as gas or water are. This gives some idea of what will be necessary if London is to be lighted electrically. Every square mile or so will require its central station and machinery, whence, radiating like a spider's web, the current may be distributed to be used for lighting or any other purpose for which electricity is available.

The effect of last night's display was very satisfactory. The illumination was sufficient, it was well diffused, and perfectly equable. Up to the present time, no other light of any kind is so good in all respects as the incandescent lamp. What the public will now require is some assurance as to the cost, safety, and convenience of the new illuminant. As to expense, there can be but one test—experience—and that has yet to be gained. Electric light, measured by candle power, can be produced by steam machinery much more cheaply than gas, and there can be scarcely a doubt that it will eventually be supplied to the public at a lower rate, provided the interests of the community are safe-guarded against monopolies. The American inventor undertakes to give a greater amount of light for the same money than the gas companies can give—reckoning not the price charged at present to yield a 10 per cent. dividend, but the actual cost of production. English electricians make the same claim, which nothing but experience can either disprove or verify. All that can be said at present is that theoretically science is undoubtedly on the side of the more perfect light; whether the full result will be at once achieved can be learned only by experiment.

Some time ago the public were startled by a fatal accident at Hatfield in connection with electric lighting, and also by the suggestion that the introduction of wires bearing powerful currents into houses and warehouses would increase the risk from fire. These alarms, so far as regards Mr. Edison's and most other incandescent systems, are needless. In the arc lamps currents of high intensity are used, and real danger exists; on the incandescent methods the tension is low, and there is no risk. Mr. Edison also introduces a fusible lead plug in his circuit, which melts when the wire gets heated, and so interrupts the current. In domestic and all ordinary lighting there can be no peril, except as the result of bad workmanship. In quantity the current produced by the giant dynamo is enormous; in tension or pressure it is so low that a person may grasp both wires and feel nothing beyond a slight tingling sensation.

In the matter of convenience electricity has yet to be tested as against gas. Electric fittings will require renewal more frequently than gas burners or globes. The incandescent lamp is supposed to live 1,000 hours, so that two or three times a year it must be replaced. Gas will possibly give less trouble, but against this advantage must be placed the risk of fire and explosion. In point of health gas properly used would be unsurpassed. Burnt in a chimney carrying off the products of combustion, without allowing them to pollute the air of the apartment, it would be a splendid ventilator. As it is actually employed a common burner fouls the atmosphere as much as the breath of ten persons. Electricity neither ventilates nor poisons; in regard to health it is perfectly harmless. Of the excellence of the new light for domestic and public purposes the people of London will now have a further illustration. Of its safety there can be no question; of its cost and convenience time and experience alone can be the final arbiters.

THE TIMES, THURSDAY, APRIL 13, 1882

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THE EDISON ELECTRIC LIGHT.

After some experimental trials during the last few weeks to insure the smooth and perfect working of every part of the arrangements, a demonstration of Mr. Edison's system of lighting the buildings and streets of a district may now be seen in London. From Newgate-street westward, across the Holborn Viaduct, to Hatton-garden, the street and most of the buildings on either side of the street are now, and for the next two months, will continue to be lit by Edison incandescent lamps. For the purpose of street lighting two of the incandescent lamps of 32 candle-power each have been placed in every lamp-post in this section, and it had been hoped that last night permission would have been obtained from Colonel Heywood for the gas to be turned out in order that the effectiveness of the Edison incandescent lamps for street illumination might be proved the more satisfactorily. Application will be made to-day with this view, and it is hoped that to-night the public will have an opportunity of judging on the matter for themselves. Those who can obtain permission to see the machinery and appliances by which the electricity is generated and distributed will find a satisfactory answer to the question which has often been asked during the last four or five years—What is Mr. Edison doing? At his laboratory in Menlo-park, where his experiments have been made, a staff of some 200 assistants has been continuously engaged in carrying out investigations on various subjects suggested for inquiry by the inventor, whose object has been, not merely to demonstrate a scientific possibility of providing a beautiful light, but to devise a practicable and economical system of supplying electricity to the inhabitants of a town from various centres, just as at present gas and water are supplied by public companies. To this end districts of New York and other towns have been canvassed and statistics carefully collected and tabulated, and, to give an instance of the nicety of the adjustment of results to cost, the greater or less thickness of the conductors would vary with the price of coal in different districts, the calculations being based on the consideration that although by increasing the sectional area of the rod the waste of electricity would be diminished, there is a point beyond which it would not be really economical to increase its size on account of the greater cost of the copper. Where, as in the north of England, coal is much cheaper than in London smaller conductors would be used. One of Mr. Edison's objects in making this trial of his system in Holborn is, indeed, to obtain such further and exact information on the requirements of a given district in London as may enable a company adopting his system to make their contracts with the businesslike certainty of results. For the first time in the history of electric lighting, he would claim, there is here perfected a system of electrical supply, consisting of means for manufacturing, regulating, distributing, and measuring electricity by meters for purposes of general consumption by all the inhabitants of a town, and not by a few individuals, whether for lighting, for driving machinery, supplying electric bells, working telephones, or for any other purpose to which electricity is now or may hereafter be put. First, as to the manufacture. There is in the basement of the premises of the Edison Electric Light Company (Limited), No. 57, Holborn-viaduct, the large dynamo-machine, by which all the lights in the district, nearly 1,000 in number, are supplied. It is called a thousand light machine, but is capable of supplying more. That is to say, as with the machines at the Crystal Palace, Mr. Edison prefers that, as a matter of economy, the machines shall be worked considerably below their power. 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2181

THE GRAMME ELECTRICAL COMPANY,

115 BROADWAY,

2182

NEW YORK.

APRIL 24, 1882.

THE GRAMME ELECTRICAL COMPANY OF NEW YORK respectfully notifies all parties manufacturing or employing apparatus to obtain light or power or to plate by electricity, that the following existing letters patent of the United States, relating thereto, owned or controlled by it and by its several members—to wit:

THE AMERICAN ELECTRIC COMPANY, OF NEW BRITAIN, CONNECTICUT,

THE BRUSH ELECTRIC COMPANY, OF CLEVELAND, OHIO,

THE EDISON ELECTRIC LIGHT COMPANY, OF NEW YORK,

THE FULLER ELECTRICAL COMPANY, OF NEW YORK,

THE JABLOCHKOFF ELECTRIC LIGHTING COMPANY, OF NEW YORK,

THE UNITED STATES ELECTRIC LIGHTING COMPANY, OF NEW YORK, and

THE WESTON ELECTRIC LIGHT COMPANY, OF NEWARK, NEW JERSEY—

will be enforced against all parties infringing the same:

No. 51,442, granted in 1865; No. 109,603, granted in 1870; Nos. 113,864—120,057 granted in 1871; No. 132,569, granted in

THE TIMES, THURSDAY, APRIL 13, 1882

THE EDISON ELECTRIC LIGHT.

presenting the appearance of a large check pattern, with
four distributing stations fed from a central station, the
mains being supplied from these stations by conductors
placed at regulated distances apart. Small plugs, each

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By

S. J. GORDON,

Its Attorney in fact.

The Times - 13th April 1882

2183

THE EDISON ELECTRIC LIGHT.

After some experimental trials during the last few weeks to assure the smooth and perfect working of every part of the arrangements, a demonstration of Mr. Edison's system of lighting the buildings and streets of a district may now be seen in London. From Newgate-street westward, across the Holborn Viaduct, to Hatton-garden, the street and most of the buildings on either side of the street are now, and for the next two months, will continue to be lit by Edison incandescent lamps. For the purpose of street lighting two of the incandescent lamps of 32 candle-power each have been placed in every lamp-post in this section, and it had been hoped that last night permission would have been obtained from Colonel Heywood for the gas to be turned out in order that the effectiveness of the Edison incandescent lamps for street illumination might be proved the more satisfactorily. Application will be made to-day with this view, and it is hoped that to-night the public will have an opportunity of judging on the matter for themselves. Those who can obtain permission to see the machinery and appliances by which the electricity is generated and distributed will find a satisfactory answer to the question which has often been asked during the last four or five years—What is Mr. Edison doing? At his laboratory in Menlo-park, where his experiments have been made, a staff of some 200 assistants has been continuously engaged in carrying out investigations on various subjects suggested for inquiry by the inventor, whose object has been, not merely to demonstrate a scientific possibility of providing a beautiful light, but to devise a practicable and economical system of supplying electricity to the inhabitants of a town from various centres, just as at present gas and water are supplied by public companies. To this end districts of New York and other towns have been canvassed and statistics carefully collected and tabulated, and, to give an instance of the nicety of the adjustment of results to cost, the greater or less thickness of the conductors would vary with the price of coal in different districts, the calculations being based on the consideration that although by increasing the sectional area of the rod the waste of electricity would be diminished, there is a point beyond which it would not be really economical to increase its size on account of the greater cost of the copper. Where, as in the north of England, coal is much cheaper than in London smaller conductors would be used. One of Mr. Edison's objects in making this trial of his system in Holborn is, indeed, to obtain such further and exact information on the requirements of a given district in London as may enable a company adopting his system to make their contracts with the businesslike certainty of results. For the first time in the history of electric lighting, he would claim, there is here perfected a system of electrical supply, consisting of means for manufacturing, regulating, distributing, and measuring electricity by meters for purposes of general consumption by all the inhabitants of a town, and not by a few individuals, whether for lighting, for driving machinery, supplying electric bells, working telephones, or for any other purpose to which electricity is now or may hereafter be put. First, as to the manufacture. There is in the basement of the premises of the Edison Electric Light Company (Limited), No. 57, Holborn-viaduct, the large dynamo-machine, by which all the lights in the district, nearly 1,000 in number, are supplied. It is called a thousand light machine, but is capable of supplying more. That is to say, as with the machines at the Crystal Palace, Mr. Edison prefers that, as a matter of economy, the machines shall be worked considerably below their power. One noticeable point in the system is its safety. The electric pressure, to borrow a term from the system of gas distributors, is so low that a child may hold the electrodes without danger; and with regard to the safety of the lamp, a handkerchief being placed over one of the globes and the glass being shattered, the instantaneous extinguishing of the light by the destruction of the vacuum is all that happens. The handkerchief is not even singed.

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2184

The New-York Times,
April 27, 1882.

ELECTRIC LIGHT MONOPOLY

THE EDISON COMPANY JOINS THE GRAMME COMBINATION.

A POWERFUL AND RICH ORGANIZATION—THE OWNERSHIP OF ALL ELECTRIC LIGHT PATENTS CLAIMED — VICE-PRESIDENT EATON'S STATEMENT.

One of the most gigantic monopolies of the age has been created by the union of the Edison Electric Light Company with the Gramme Electrical Company on the 22d of last month. By this combination the several large companies that claim to control all of the patents applying to existing systems of lighting by electricity are formed into one monster organization. The Gramme Company was established in the latter part of April, 1881, and, prior to the joining of the Edison Company, was composed of the American Electric Company, of New-Britain, Conn., the Brush Electric Company, the Fuller Electrical Company, the Jablochkoff Electric Lighting Company, the United States Electric Lighting Company, and the Weston Electric Light Company. All of these companies were possessed of valuable patents, and were supposed to be backed by ample means. So strong, in fact, did the Gramme Company consider itself that it announced, by circular, that the patents owned by its members covered "the fundamental principles involved in all the existing systems of lighting by electricity and cannot be successfully avoided by outside companies." As the Edison Company was at that time one of the "outside companies" it might reasonably be inferred that the language of the circular was directed at that company as well as to smaller and much less powerful organizations.

The first annual meeting of the Board of Trustees of the Gramme Electrical Company was held at the company's office in the Boreel Building, Broadway, on Tuesday afternoon and yesterday morning, and the first annual meeting of the stockholders of the same company was begun yesterday afternoon. Mr. Henry I. Hoyt, President of the Gramme Company, presided during the former meeting, and Major S. B. Eaton, Vice-President of the Edison Electric Light Company, was Chairman of the stockholders' meeting. The character of both meetings was more conversational than otherwise, the objects, prospects, and internal policy of the great organization being informally discussed. It was announced that among other topics brought up for consideration was the best methods to be pursued to gain public confidence in a responsible system of electrical lighting. The stockholders' meeting was attended by the following named gentlemen: Henry I. Hoyt, W. H. Appleton, R. B. Minturn, C. R. Flint, Col. R. R. Hazard, the Hon. M. D. Leggett, George W. Stockley, Major S. B. Eaton, C. Goddard, W. Parker, J. J. Skinner, W. M. Ivins, A. B. Chandler, C. A. Cheever, and G. W. Hebard. The meeting was adjourned until 11 o'clock to-day, when, it is expected, there will be an election for officers.

Prior to this meeting it had not been generally known that the Edison Company had joined the Gramme Company, and upon THE TIMES's reporter expressing some surprise that such should be the case, President Hoyt promptly replied: "Oh, yes; the Edison Company are with us."

"How was the union brought about?" was the very natural inquiry.

"Well," said President Hoyt, "the Edison Company could not very well do anything else than come in. You see, the Gramme Electrical Company own patents that cover every system of electric lighting, and there is no company that would care to stand out against us." Mr. Hoyt then entered into an explanation of the extent, power, and purposes of the Gramme Company. He said that public confidence had been shaken in the electric light enterprises by the organization of "wild cat" stock companies, whose only object seemed to be to foist a lot of worthless stock upon a gullible public. Such companies were being organized all over the country. They owned no patents and were for the most part entirely irresponsible. Frequently they would buy machines from other companies merely to place on exhibition in order to secure a sale of their stock. "Why, Sir," exclaimed Mr. Hoyt, indignantly, "I have even had men come to me and ask to borrow dynamo-electric generators to exhibit in the offices of the so-called 'electric light companies.' Now, one of the chief objects of the Gramme Company is to stamp out all such fraudulent concerns. I have here a list of 40 or 50 of them, and the agents of our company keep themselves thoroughly posted as to the movements of all such speculative enterprises. We shall endeavor to break up their practices as soon as possible. It is absolutely necessary to the success of the legitimate electric light companies that the public should be fully informed regarding the worthlessness of many enterprises in which they are invited to invest money." Other officers of the Gramme Company were enthusiastic in their assertions of what the extensive and influential organization proposed to do. It was believed that the several companies belonging to the Gramme would reap untold advantages. In the first place, uniformity of prices will be secured, more perfect harmony of action will exist, and the necessary litigation between the companies will be simplified and made much cheaper. As for outside companies it was declared that active steps will be taken to wipe out every electric light company in the country unless they should have something new and worthy of consideration in the way of an electric light. The statement is also made that there is probably not a patent lawyer in the country of any prominence or special ability who is not engaged in the interests of the Gramme Company.

Major S. B. Eaton, the Vice-President of the Edison Electric Light Company, was called upon at his office by a TIMES reporter and asked if he would explain why the Edison Company joined the Gramme Electrical Company. He replied: "As long ago as last August a committee representing the Gramme Company and a committee from our own company were appointed to confer as to our joining the Gramme organization. Those committees continued their conferences until recently, when, agreeable arrangements having been made satisfactory to the Gramme Company and its constituents, we, on March 22, became members of that organization. As regards the Gramme Company's patents, our present attitude is just what it has always been, viz., that we do not use the Gramme machine, and that the Edison machine in no sense whatever infringes the Gramme patents. Our reasons for joining the Gramme Company had nothing to do with the Gramme patents. We desired to avail ourselves of the advantages of a business organization controlled by people engaged in enterprises similar to ours, and united to promote harmony, uniformity of prices, and simplicity of litigation, and also to prevent the public from being imposed upon by new companies without patents and without integrity. A very important consideration with us was that we wished to avoid being hectored by every new company that unprincipled parties disposed to steal our inventions might get up. Such companies spring up daily. It is one of the functions of the Gramme Company to strangle all such organizations, and we would gladly join the Gramme Company just for that one convenience of having somebody else take off our hands the tiresome and expensive task of putting so many other combinations to death."

"Could the Edison company have prosecuted its business successfully had it remained independent of the Gramme Company?"

"There is no reason at all why it should not have been able to do so. The Edison Company is devoted exclusively to incandescent lighting, and all of the other companies composing the Gramme combination are, with a single exception, devoted exclusively to arc lighting. The patents possessed by the arc-lighting companies have nothing whatever to do with our business, the two systems of illumination being totally unlike. The company referred to as the exception is the United States Company, which owns the Maxim incandescent light, and I have never heard any one say—not even the Maxim people themselves—that our patents infringe upon theirs. The real issue between the Edison and Maxim people is that the latter's lamp is a square infringement upon Mr. Edison's."

"Had your company been threatened with prosecution for infringing patents held by the Gramme Company prior to your joining that organization?"

"No, Sir. Our company has never been sued nor threatened with suit either by the Gramme Company nor by any member of the Gramme Company. Nor have we been sued or threatened with suit by any other company or inventor. We are the people to do the suing, as with reference to incandescent lighting we have exclusive ownership. In our suing processes we shall enjoy cer- [illegible] of the Gramme Company. In that company are three important committees, viz., a Committee on Shortening and Cheapening Litigation, a Committee on Harmony, and a Committee on Prices. It is the duty of the first named committee to simplify all litigation and, if possible, to harmonize the differences. At any rate, all litigation between the companies in the Gramme will be tried by reference before skilled men without going into court. The Committee on Prices will see to it that each company shall sell the same quality of goods at uniform prices."

"The Gramme Company is destined to become an absolute monopoly in electric lighting, is it not?"

"Yes," was the answer, "the company had a monopoly of arc lighting before, and now that they have got us in, they have a monopoly of incandescent lighting as well."

"How much capital is represented in the Gramme Company?"

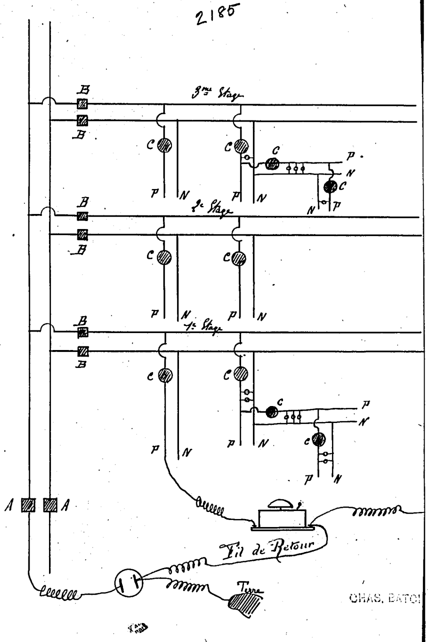
"That is something I cannot tell you at present. I might by figuring up the value of the stock of each company interested."

"It amounts to a great many millions of dollars does it not?" asked the reporter.

"Yes; the stock of the Edison Company alone is worth $5,000,000."

The Gramme Electrical Company will probably settle upon some definite line of policy at the meeting to-day. Notice is given in their circular that "all parties manufacturing, selling, using, or having in their possession electrical apparatus which infringes the patents of the Gramme Electrical Company will be prosecuted to the fullest extent of the law."

2185



CHAS. BATC

Boston Daily Globe.

MONDAY, APRIL 24, 1882.

2186

INCANDESCENT.

American Electric Light Company Stockholders.

The Claims of Both Sides of the Controversy,

With Much Very Interesting Inside Information.

The long pending trouble among the stockholders of the American Electric Light Company has finally come to the surface through an ex parte statement published in a contemporary. There are two sides to every question and through the assiduous labors of GLOBE reporters both sides of the controversy are given below, with the views of a disinterested party well posted in the affairs of the company. A brief history of the American Electric Light Company of Massachusetts, so far as its relations to the general public are concerned, are of paramount interest. In the early part of last summer, Messrs. William McMahon, Edwin M. Fox and George Crosby of New York, claiming to be the chief owners of the stock of the American Electric Light Company of New York, came to Boston for the purpose of organizing a branch of the New York concern in Massachusetts. Various capitalists were approached, and public men were notified to examine the merits of the enterprise which it was proposed to inaugurate. A provisional company was organized under the laws of the State of Massachusetts. An application for a charter was filed in the office of the secretary of the Commonwealth. The commissioner of corporations gave the parties a hearing, read the official reports of their company, examined their patent certificates, and finally decided that on the guarantee that a certain sum of money had been paid into the treasury of the company he would allow the

Patents of the Company to Stand as the Balance

representing so much cash. Meantime a public exhibition of the two systems of lighting, the arc and the incandescent, was given in the City Hall by authority of the City Council under the direction of the committee on public buildings. The office of the Mayor was completely wired and some twenty-five or thirty incandescent lamps were put in position. A dynamo machine was placed in the engine room, and the engineer of the City Hall co-operated with the managers of the enterprise in the erection of machinery, and furnished the power from his engine. The exhibition was a complete success. Everybody who saw the light declared it to be entirely feasible for inside illumination and went away completely convinced that the days of a gas monopoly were numbered. The incorporators of the company decided to issue stock to the amount of $1,000,000, 10,000 shares at $100 per share, par value. The commissioner of corporations required, as before stated, the guarantee of a certain portion of the capital stock to be paid into the treasury in cash. On the sworn statement that $100,000 had been so paid in, a charter was granted and the company became one of the corporations of the State of Massachusetts. During the exhibitions at the City Hall, Mr. E. H. Goff, who had been known in financial circles as a mining operator, became interested in the enterprise. He induced several capitalists who had been interested with him in other schemes to inspect the light, and to ask questions of the inventors for the purpose of satisfying themselves of its feasibility as an illuminating power. Early in January Mr. Goff declared himself ready to organize a new company and to purchase from the provisional company all its charters, franchises and effects. As near as can be ascertained, the basis of agreement between the new company and the old was that the original owners, namely, McMahon, Fox and Crosby, should receive a stated sum for their entire interest in the Massachusetts corporation. The $100,000 that had been certified to before the commissioner of corporations as having been paid into the treasury was understood to represent a transfer of 1000 shares of the capital stock at par. There were 1000 shares set aside as treasury stock, which were to be sold for the accumulation of a fund for running expenses, and as a portion of the purchase money for which the new company made itself liable in its agreement with the original owners. It may be an interesting question, and one which only future developments can settle,

Whether the $100,000 Was Ever Paid Into the Treasury,

and if so what has become of it. The new incorporators who testified on oath that this money had been paid in will, in all probability, be called upon to give a detailed statement of the manner in which it was expended, and also of the disposition of the stock which it was supposed to represent. Mr. Goff was elected vice-president of the company and became, through the absence of the president, Colonel Grant, the responsible representative and before Major Haldeman's connection with the company, its general manager. The elegant offices were fitted up, machinery purchased, glass blowers, electricians and experts in various departments of lamp production were imported from New York and Germany, and the company soon attracted public attention by its elegant displays of incandescent lamps in the large show window at 160 Tremont street. Certainly to the outside world no company of its kind ever had a better chance to become speedily and solidly established in this city. That in the short space of four months all the brilliant prospects which it held out to investors and to original incorporators could be wrecked and ruined is an evidence either of gross mismanagement or gross fraud. It is understood that legal proceedings will be instituted at once and that the public will have the whole story laid before them, so that the questions of fraud and incompetency can be definitely settled.

MESSRS. GOFF AND HALDEMAN

Representing One Side of the Controversy—They Claim to Have Been Victimized.

Mr. Edward H. Goff and Major C. S. Haldeman were seen by a GLOBE reporter yesterday morning at the old office of the American Electric Light Company, on Tremont street. Mr. Goff was the principal spokesman in the conversation which followed; but Mr. Haldeman frequently directed the line of thought or made suggestions, so that the interview may be justly said to embody his views of the matter. "The long and short of the whole business," said Mr. Goff, "is that we have been victimized. Representatives of this New York concern came here for the purpose of forming a company, getting a charter to enable them to place stock, but never to do any business. That was the whole matter. They came here to the City Hall to show their light because the thing would have a good sound if it seemed to come from the City Hall. They exhibited their light. As an experiment, it was all right. As a plaything, it was a success. It worked all right in the City Hall, but when it came to putting it up and running it week in and week out it would not do at all. We were completely deceived by misrepresentations. We were told time after time by Stephen Moriarty that the American electric light was to be used in all the public buildings belonging to the government. I think that Fred and Jesse Grant, on the strength of whose connection with the company partly we were induced to go into it, were perfectly square in the matter, but I can't say that of some other gentlemen.

"It was only about six weeks ago that Moriarty came into this office and said that he could tell us some splendid news. Platt, he said, had resigned from the United States Express Company, and was to accept the presidency and general management of the New York company. He stated that positively. This is only a specimen of numerous such statements. McMahon represented that General Butler was largely interested in the company, and went on to Washington to make a personal examination of the company's patents, and that he decided that the patents of the American company were vastly superior to Edison's, and then a report

Purporting to be Written by General Butler

was put into our hands, which was subsequently printed. We were also told by McMahon that Butler had purchased the rights for the city of Washington, investing a large amount of money in the same, and that he was engaged in forming a company there. McMahon has from the first claimed that Jay Gould was a large owner in the company; that he had $300,000 invested in the New York company, and was the financial backer of the company with the Grants. McMahon told me several times that Mr. Woodworth, president of the Ames Manufacturing Company, was willing to buy the rights of Springfield and Lowell of this company and pay cash $25,000 and 5 per cent. on the capital stock of the company organized in those two towns, and at one time he brought a letter which he said came from Woodworth making such an offer; but he took the letter away with him.

"Mr. Stephen Moriarty has an interview in the papers in which he says that the Boston parties organized the American Electric Light Company of Massachusetts. This I wish to deny in toto, as the company was organized about a year ago, as can be seen by referring to the official records at the State House. I do not know who the incorporators were, but of course the records will show." (The company was formed May 19, 1881, by George H. Moller of New York, James W. Fox and Patrick A. Collins.) "Myself and friends had nothing whatever to do with the organization of the company, and knew nothing about it until we were requested by Colonel Fred and Jesse Grant and Moriarty to become interested in it, and were elected directors in the early part of January. The board of directors were elected here on January 7. Fred Grant was chosen president, myself vice-president, Major Cyrus S. Haldeman general manager, E. H. Hastings secretary, and Eugene M. Horsey treasurer. It was stated in the Moriarty interview above referred to that Fred Grant was chosen temporary presi-

dent and acted in that capacity for one day. Notice the date of the following letter:

OFFICE OF
TEXAS WESTERN RAILROAD COMPANY,
NEW-YORK, March 20, 1881.

To the Board of Directors of the American Electric Light Company of Massachusetts:

I have the honor to hand in my resignation as president and also as director of your company. My reason for doing so is that my business here and in Texas will not permit my attending to the affairs of your company. I am, gentlemen, with great respect your obedient servant.

(Signed) F. D. GRANT.

"His resignation has never been presented to the board, because there has not been a meeting of the directors since. When asked first about the charter of the company Mr. Moriarty told me in December last that the charter had been granted some months before, the stock paid up in full and a final certificate issued. Upon Mr. Moriarty's being asked by my attorney, Hon. D. W. Gooch, how the stock was paid up, he said it was

Paid by Jay Gould's Check for $1,000,000,

which was given to the Grants to pay for the stock to comply with the law. Afterwards, when we came to form the Boston board of directors it was ascertained that this was not true. The stock had not been paid up, and it was then accomplished by a valuation of the patents by different electricians, whose affidavits were procured by the New Yorkers, valuing the patents at $1,000,000. The valuation was anticipated, as I was informed by the commissioner of corporations, at $900,000. Then they said that they required $100,000 to be paid into the treasury in cash, which could afterwards be used by purchasing 1000 shares of the stock of the company, which they proposed to put into the treasury, and had already issued in the name of the company 1000 shares to the American Electric Light Company of Massachusetts, dated September 8, 1881. Upon their earnest solicitation, I raised $100,000, and paid it into their treasury for them in cash, which was afterwards used, by resolution of the directors, to purchase the 1000 shares of stock referred to. And that 1000 shares of stock with the record book of the company is all that was ever turned over to us, and which, since the resignations of the directors, has been left in my hands for safe-keeping. I may say, right here, that, after notifying the several parties interested that I was ready to hand over these papers to any one who might be legally appointed to take charge of them, they have failed to accept the offer, and I now intend to turn them all over into the hands of the court for safe-keeping. I have placed them in the hands of our attorney for that purpose.

"As soon as the directors had been elected we began to advertise largely and made extensive preparations for business. Then, in accordance with our previous understanding with them, we called on the New York Company for dynamo machines and other stock, but the call had no other effect than to draw out excuses from the New York concern that they were too busy to attend to us. It was because we got tired of these excuses that we bought a portion of the electric plant of the American Electric Company of New Britain, Conn., supposing that company would, by sales of its treasury stock, be able to pay the debt, or that when our stock came from New York we could replace what we had obtained from New Britain. We soon found that we were running business without any plant of the New York company,

Paying Bills Out of Our Own Pockets,

and that the advertising we were paying for was being used to unload stock held by private parties here, as well as stock of the New York company, this market being literally flooded with it by numerous brokers who held it and were advertising it for sale privately at very low figures. When we protested against this, the New York people promised that it should be discontinued. It was also promised that other stock held by private parties should be placed in a pool and put in the hands of the International Trust Company. In fact we were informed that everything was all right, and March 31 I received the following despatch from George Crosby:

NEW YORK, March 31, 1882.

Pleased to hear good news from Boston. Just returned from Washington, leaving the national capital flooded with the American electric light; halls and art galleries illuminated. Thousands are viewing it, all pronouncing it a grand success. Government going to adopt it. Things booming all along the line.

"In reply to a note of inquiry from me I received the following telegram from Colonel Hooker on the subject:

WASHINGTON, D. C., April 3, 1882.

No electric lights in the Capitol or art gallery at present. Are putting in wires to exhibit in basement of Capitol in few days.

"In reply to the letter of resignation from Fred Grant I sent this:

April 3, 1882.

Colonel Fred Grant, No. 3 Wall street, New York:

Your letter of resignation received, and will be acted upon at next directors' meeting. Personally, I protest, considering you and your associates responsible for inducing me to go into the company.

EDWARD H. GOFF.

"To E. M. Fox and George Crosby, on the same day, I sent a telegram, of which this is a copy:

BOSTON, April 3, 1882.

Grant has sent resignation as president and director, and insists upon immediate acceptance. We also learn that your telegram regarding lights in Washington is untrue. Therefore Hersey and others refuse to act longer as officials of the company. I see no other alternative but to resign and state the whole facts. I cannot, in justice to myself and others concerned, do otherwise. What ... you to ...

... shortly Mr. Crosby:

NEW YORK, April 3.

Have this to say—That my wire to you from Washington was true, and that, whoever says to the contrary, lies; if you say so, you lie. You have played your game of bluff long enough. There is a day of reckoning coming with you. From all I can learn you have carried on a worse game than the Huston Ships Berth Company, and the stockholders are going to look into your dealings.

"My answer to this telegram was immediate and decisive, and read thus:

BOSTON, April 3, 1882.

Mr. Crosby's telegram received and placed in the hands of our attorney, together with other telegrams and papers which will show, if made public, who has been playing bluff. My informant from Washington cannot be disputed. Your abusive language renders further business relations impossible.

"Then We Immediately Sent in Our Resignations

to the New York company, and the following letter to Fred Grant:"

Colonel Fred Grant, Wall street, New York:

Your communication addressed to the board of directors duly received and placed on file. Since that time several other directors have signified their intention to resign, and have sent them in. Of course, if all resign, they cannot be acted upon and others appointed to fill their places, and I would therefore suggest that you indicate a time at which you could be present at a directors' meeting and authorize the secretary to call the same.

E. H. GOFF, Vice-President.

"To this I have received no reply, and the resignations all stand, like the company itself, in statu quo. Messrs. Hersey, Haldeman and myself ceased acting for the company immediately after the telegram of April 3, and so notified every one here who was doing any business with it. We then, after selling out the lease of the Tremont street store, moved up stairs, and in our new apartments began the formation of a new company, as we have no intention of going out of the electric light business.

"This is about the state of the case. I have personally lost $20,000 by the business, and do not feel as though I could lose any more. The statement made by Mr. McMahon that some $70,000 or $80,000 of stock had been sold under our management is grossly untrue. Whatever stock has been sold through the influence or agency of the directors here we propose making good to the utmost extent of our ability by giving them stock in the new company which we have formed, nearly all of which has already been exchanged."

THE OTHER SIDE.

Statements From Several Parties Tending to Disprove the Allegations of Messrs. Goff and Haldeman.

The articles in the morning papers of Sunday in relation to the American Electric Light Company of Massachusetts created a profound sensation in this city, involving as it did the names of some of our best known citizens. An immediate and searching investigation was at once made by a GLOBE reporter to ascertain, if possible, the truth or falsity of certain statements made. Several parties were seen who professed ignorance of the matter, but subsequently did give scraps of information that helped along the line of investigation pursued. Persons known to be conversant with the inside history of the company refused to talk, and sent the reporter to others, who, though not directly interested, gave the reporter to understand that the story published in a contemporary was susceptible of another interpretation, and from all that was gleaned, directly and indirectly, the following resume of the situation may be inferred to be a statement of facts calculated to disprove the assumption of Mr. Goff and his friends, as published yesterday. More than four months ago the gentlemen interested in the electric light company investigated the method of the production of the light, saw the patents, obtained expert opinion, secured General Butler's report, and became satisfied as to its value. Having done this, they, by fully advertising and other means, told the public that it was a valuable invention. They held the stock at $100 per share, par value, and sought to sell and did sell more or less stock, nobody knows how much. Having done this, they followed with the unprecedented action of getting out duplicate stock and other books, and of getting a duplicate seal of the company made, all of which they kept at the office on Tremont street, while the genuine and original seal and books were in the custody of the International Trust Company, placed there by the owners of the stock, known only to the management, and understood by them to be the only books showing the stock transactions of the company. The trust company was custodian of the books and seal, and the financial agents of the electric light company. The stockholders of the company made repeated demands to see those books at the Tremont street office, to ascertain what they were and what the management was doing, but were put off on one pretext and another. After repeated efforts they learned that considerable stock had been issued from the books on Tremont street, which was

Not Registered on the Company's Books

at the trust company's office, all of which was unauthorized and illegal. They also ascertained that in some mysterious way, by vote of the management or otherwise, the $100,000 paid in had disappeared, the treasury was empty, and the property and contracts of the company, it is alleged, had been assigned and transferred to Prescott, Hersey, Hastings & Co. for supposed advances ... when the company had $100,000 in their coffers. In view of this allegation, it may be well to look at the connection of the firm above mentioned with the electric light company. The firm is composed of Mr. Edward H. Goff, vice-president and executive officer of the electric light company; Edward H. Hastings, clerk of the same company; Eugene M. Hersey, treasurer of the same company, and Mr. Prescott, who was constantly at the office of the company. The other members of the board of direction, consisting of Mr. Dudley C. Hall, Henry Hastings, Lansing Millis, Bradley Barlow, Hon. William Windom and Colonel Hooker, who were elected upon the representations that they were capitalists and were associated with the others in the enterprise, seem to have been dropped for a while, and as Colonel Fred Grant had gone to Texas to attend to some important railroad business, the absolute control and management of the company and its business was in the hands of this firm, together with Major Cyrus S. Haldeman, who had been selected by them as general manager, and Fogg Brothers & Co. (one of whom, John S. Fogg, was also a director) as financial agents. The above gentlemen controlled the franchise of the company, and obtained it upon the promises that they would furnish the requisite capital in addition to the $100,000 already paid in and push the business as a legitimate mercantile venture. After a time they opened negotiations with the New York company, with a view to the consolidation of the two companies, and had an interview with a committee of the New York company, in which they held out as an inducement to consolidation that the Boston company was in the above-mentioned competent business hands, with $100,000 in the treasury, all of which they offered to make affidavits to if necessary. Meanwhile these gentlemen, it is understood, had entered into certain contracts with the owners of some of the stock for a delivery of the same upon certain terms and conditions, under which Mr. Goff did obtain some of the original stock, it is alleged,

By Giving a Draft which was Never Paid.

This was a recent transaction, made at about the same time that they suddenly found out the whole matter was a fraud. In fact, it is stated that when the draft came due the gentlemen suddenly discovered that the property and patents of the company were not what they originally supposed them to be, though they had made no recent investigation or discovery, unless the so-called impudent despatch from Crosby was so construed. The property and contracts of the company had been deemed, however, of sufficient value to be gobbled by Prescott, Hastings and Hersey. About the same time they suddenly thought that a new mine could be worked, and the result was that a new company was organized under the laws of Maine, which has recently blossomed out in the Tremont street garden, under the tender care of the same management. The stock of the new company is apparently used to satisfy the persons who hold certificates of the over-issued stock of the old company, and thus cover up that singular transaction. When all these things had reached a focus, and legal proceedings were about to be instituted by the stockholders of the American Electric Light Company against the managers touching the above and other transactions of a like nature, they suddenly pretend to discover they have been all along deceived as to the value of the patents and inventions controlled by the company, and to get the ear of the public first ventured upon the so-called expose of yesterday. The courts will, however, deal with them and it. The above resume, gleaned piece-meal and fitted together, reveals a state of affairs that promise interesting developments when the matter gets before the proper tribunal which shall determine upon its merits.

MR. WILLIAM McMAHON.

He Declines to Go Into Details, Preferring to Await the Action of the Courts.

Mr. William McMahon was seen at his hotel yesterday afternoon, and was asked in relation to an article that appeared in one of the Sunday papers, and also in regard to his relationship with the electric light company. He said he had read the article, and would state that it was a base fabrication from beginning to end. He did not care to go into the details of the matter, as everything would appear in due time before the proper tribunal, which would judge upon the legal aspects of the case. Being urged to give an expression of his views upon the subject, as in all probability the other side would have something more to say, he reluctantly gave the reporter the following statement: "Several days ago I consulted counsel and began proceedings for the protection of my own and other interests in the company, having learned all the facts necessary for such proceedings. But before and since, strenuous efforts, combined with threats and entreaties, have been made by these gentlemen in question to deter me from taking any legal steps in the premises. I am not surprised at what I see in the papers, knowing what I do of its source, and this being one of the things that was threatened. I should not have been surprised if the published statement had been stronger and wilder, nor shall I be surprised to find it followed by others of a kindred character, as drowning men generally catch at straws. The case of the stockholders against the managers, however, will be taken care of in due season by the proper tribunal. It would be undignified, unfair and indecorous to anticipate ... thus taken, or to forestall or prejudice public opinion, as they have attempted to do. Statements are to be weighed by the circumstances under which they are made. Those that are made under the pains and penalties of perjury in a searching legal investigation will be accorded a much higher value than those already printed, purported to have been made by gentlemen in anticipation of appearing in court." The reporter then said to Mr. McMahon: "What do you purpose to do?" He replied: "I have placed the matter in the hands of counsel and shall remain here, and am prepared to meet the fullest and most complete investigation." The gentleman declined to talk further.

IN NEW YORK.

Much Talk Made Over the Matter—Fred Grant Refuses to be Interviewed.

NEW YORK, April 23.—The sudden closing up of the American Electric Light Company of Massachusetts was the subject of much comment at the hotels and public places up-town today, and the fact that Colonel Fred Grant was president of the company caused the subject to be invested with still greater importance. From various statements it appears that stock was offered here at all sorts of prices, ranging from $1 to $10 per share, while Boston stock was kept at par. All efforts to interview Colonel Grant were fruitless. He sent word to the reporters who called that he was engaged. It was said that that gentleman, Edwin M. Fox, who is one of the originators of the company, and several other gentlemen were closeted together today discussing the matter. Not less than 5000 shares of stock remain to be accounted for, and it is believed that some rich developments will be made when the affair is thoroughly investigated. The friends of Colonel Grant claim that the failure was due to the non-fulfillment of the promises of the Boston men.

IN GENERAL.

Mr. Fox's Mission.

Two months ago a syndicate was formed in this city to start a company in San Francisco, and Mr. George Crosby, one of the original owners of the American Electric Light Company's patents, and James W. Fox, General Butler's law partner, are now in San Francisco for the purpose of exhibiting the light and organizing a company.

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THE DAILY GRAPHIC:

NEW YORK, APRIL 27. 1882.

2188

JAMES GORDON BENNETT'S NEW YACHT.

The most artistic and the most perfectly equipped vessel now afloat is the Namouna, Mr. James Gordon Bennett's new steam yacht, of which we give illustrations on another page. Nothing that money, skill and good judgment and good taste could do has been left undone. A small fortune has been spent on her, but the result is something to be proud of, and when Mr. Bennett's royal friends and acquaintances on the other side of the Atlantic gaze on her they are sure to envy him her possession.

The interior decorations of the Namouna are such as have never before been seen on a vessel—not even the Czar's Livadia. The best artists that this country possesses in this line were employed, and the effect produced is such as but few if any palaces or private residences on shore can rival. The woodwork of the various divisions is all of the richest, and each is of a different kind from the other. That in the ladies' cabin is of mahogany that in the main saloon of English oak, and Mr Bennett's private apartments in cherry. The ceilings are all elaborately frescoed, and the bed on which the owner is to repose cost $1,000 alone. The Edison electric light illuminates every part, the successful application of that light on the steamers of the Oregon Railway and Navigation Company having demonstrated its superiority.

The engines were built by Ward, Stanton & Co. of Newburg, N. Y., and are of 400 horse-power; high pressure cylinders, 22 inches in diameter; low pressure, 42 inches; stroke of piston, 28 inches. The boilers are two in number—shells 13 feet in diameter, 11 feet long, 120 square feet grate surface and 3,000 square feet of heating surface. Two pairs of valves manufactured by the Consolidated Safety Valve Company, of New York, and known as the Nickel Seated "Pop" Safety Valve, have been placed on the boilers. These valves are 4½ inches in diameter, and adjusted to allow a working pressure of 80 pounds to the square inch. The bearing surface is made of solid nickel castings, which prevent corroding or sticking fast in the seat. They are spring loaded, and will open and close on a variation of only two pounds pressure, and all the working parts are arranged with a lock-up device, which prevents any possible tampering with the valves. The steam gauges, clocks, revolution counters and engine indicators for the engine and fire rooms are all of the most approved patterns, having been furnished by the Ashcroft Manufacturing Company of Boston. These important appliances are all in elegant silver-plated cases, the dials being of the same material and elegantly engraved.

THE SUNDAY ~~HERALD~~

SUNDAY, APRIL 23, 1882

2189

A QUEER SWINDLE.

Collapse of the American Electric Light Company.

How Gen. Grant's Sons Figure in It.

A Suggestive Chapter for Speculators.

The American Electric Light Company of Massachusetts, claimed to be regularly incorporated under the state laws, and to which a charter was granted over a year ago, has collapsed under circumstances indicating beyond doubt a flagrant swindle on the part of some person or persons as yet not definitely known; that is to say, allegations are freely made, and charges of fraud freely laid, by the parties interested, at the feet of various prominent New York and Boston men, among whom are Col. Fred D. Grant, son of the ex-President; Stephen Moriarty, a partner of Jesse Grant, an ex-Bostonian, who will be readily remembered by many here as a young gentleman of decidedly eccentric tendencies, and who has since, having made a reputed fortune by stock speculations, been living in style in Gotham; one E. M. Fox, a New York lawyer; one George Crosbie, also of New York, and one William McMahon, another New Yorker. The Boston parties chiefly concerned in the company's collapse are Edward H. Goff, vice-president of the company; Edward H. Hastings, secretary; Eugene M. Hersey, treasurer, and one or two others, whose names are withheld for the present. The statement of Mr. Goff, who presents the Boston side of the story, is given below, and, of course, is only the Boston version of the affair. Developments expected from the New York people concerned may throw new light on the subject, though, from present hasty investigations, it would appear that these same New Yorkers are responsible, in a large measure, for the collapse. The American Electric Light Company, it will be remembered, started only a few months ago with a great flourish of trumpets in the shape of heavy advertising, glowing prospectuses, handsomely fitted apartments on Tremont street, with the incandescent and electric lights, the alleged patented inventions and property of the company, making a splendid display in the windows by night. The capital stock of the company was advertised for sale at $115, and, as far as can now be ascertained, the amount placed was not large, suspicion having been entertained in certain quarters from the first that everything was not as it should be. The failure leaves the company owing about $15,000 for material, fixtures, etc., while the number of shares sold, as far as can be ascertained, does not exceed 200. This number, however, does not include the shares alleged by the Boston parties to have been placed by the New Yorkers on this market in considerable quantities, and sales of which were negotiated at a figure less than the par value ($100) of the stock.

EDWARD H. GOFF'S STATEMENT.

Said Edward H. Goff yesterday afternoon: "In December last I was invited by Col. Fred Grant, Jesse Grant and Stephen Moriarty, partner of Jesse, all New York brokers, to interest myself in the American Electric Light Company of Massachusetts, which, they said, had been duly chartered by them under our state laws, and in which they owned a controlling interest. Their arguments pointed to the enormous amounts of money made by the Brush and Edison Electric Light Companies, and they added that the patents owned by the American Electric Light Company of Massachusetts and the American Electric Light Company of New York, the latter of which was then in operation, were vastly superior to any of the patents of other inventors. They stated that their electricians had nearly all been taken from Edison's most skilful workmen, and were the best in the country. These men pointed out to me a chance to make much money, and invited me to take hold of this Massachusetts company, which, you will understand, though duly chartered, had not yet been organized, and put in working condition. It was stated to me that firms of such standing as George William Ballou & Co. and Kidder, Peabody & Co., who had seen the value of the inventions, were desirous of securing rights for New England entire. Under these representations I talked to some of my friends, and soon afterward Moriarty and the Grants came on here on several occasions and continued their solicitations. About this time a public exhibition of the arc and incandescent system, which they claimed was the property of this company, was given in City Hall, and was superintended largely by three men who, I afterward learned, were principal stockholders in the company. These men were William McMahon, George Crosby and E. M. Fox, all of New York, the latter being a lawyer, and, at that time, secretary of the New York company. We were told by these gentlemen that Gen. Grant and sons were large owners in the New York company, as well as Senator Windom

AND EX-SENATOR PLATT,

the two latter being directors. McMahon also intimated to myself and friends that Jay Gould was a large owner in and financial backer of the New York company. With such prominent men as I have mentioned behind the New York scheme, and with the Massachusetts company to be worked on the same valuable patents, etc., we were all completely disarmed from making proper investigation, and finally consented to take hold of the company and invite our friends to join us in making up a board of directors and otherwise organizing and proceeding to business. Let me say here that we had also been informed that Gen. Butler was the attorney of the American Electric Light Company, and had given up a similar position in the Edison company, because he was satisfied that the patents of the first named were the original ones. Beside this, Gen. Butler was said to have made a report on the relative value of the systems of the two companies, much to the advantage of the American. We were led to believe that these representations were all true, and in January last the gentlemen who had with me become interested in the scheme, met here and elected a

BOARD OF DIRECTORS.

Fred Grant was chosen president, myself vice-president, Maj. Cyrus S. Haldeman general manager, E. H. Hastings secretary and Eugene M. Hersey treasurer. Among the directors were Hon. Bradley Barlow of Vermont, Col. George W. Hooker of Washington, Fred Grant, Senator Windom, Henry Hastings, Dudley C. Hall and others. All the board of directors, aside from Col. Grant and Senator Windom, were elected and accepted office at the solicitation of Mr. Hersey and myself. Of course, we repeated to our friends and these men, as well, the representations made to us by Moriarty and Grant. In a few days after the election, Messrs. Hastings and Hall of the directors resigned, and one of the vacancies was filled by the election of John S. Fogg of Fogg Bros. & Co., the Sumner street bankers. Mr. Fogg was made a member of the finance committee, and his house accepted the selling agency of the stock of the company. All the directors, by the way, are made eligible by transfers of stock from the New York parties. At once we began to advertise very heavily, took the apartments on Tremont street, put a small plant in the basement, and also rented a portion of the Mechanic fair building for the purpose of putting in there machinery and fixtures for lighting the entire city. Shortly, in accordance with promises made, we called on the New York company for dynamo-machines and other stock; but their excuse was they were very busy, were making daily changes in their machines, putting in new ones, etc., and that we had better delay action a few days. These excuses continued until we grew tired, and concluded to buy a portion of the electric plant so-called of the American Electric Company of New Britain, Ct., supposing that company would, by sales of its treasury stock, be able to pay the debt, or that, when our stock came from New York, we could replace what we had obtained from New Britain. Very soon, however, we found ourselves running business here without any plant of the New York company and paying bills out of our own pocket. We also discovered, to our surprise, that the advertising we were doing and paying for was being used to unload stock held by private parties here, as well as stock of the New York company, this market being literally flooded with it by numerous brokers who held it and were advertising it for sale privately at a startlingly low figure. Of course we protested against such business, and the answer we received from the New York people was that it should be discontinued. It was promised, too, that other stock held by private parties should be placed in a pool and put in the hands of the International Trust Company. As soon as Messrs. Hersey, Haldeman and myself became suspicious and complained accordingly, we were told that 'everything was all right,' and the new dynamo-machines would be ready and sent on in a few days. Then Moriarty came here several times, and told us they had secured a new arc system which would surpass anything yet patented, and which, also, would be 'ready in a few days.' It could be run, Moriarty claimed, much cheaper than any other similar light, and 10-arc lamps by this system would cost but 1 cent an hour. So much for their promises. About the last of March we began to get very uneasy, and, in fact, notified the New Yorkers several times that we had lost all faith in their representation and did not believe in the stability of the company or the value of its patents. (Let me say, right here, that, of the $1,000,000 capital stock of the Massachusetts company, $900,000 was represented to be in patents, while $100,000 was in cash.) Well, they evidently thought something must be done to

STIMULATE OUR DROOPING ENTHUSIASM,

and on the 31st of March I received the following dispatch from George Crosby:

New York, March 31, 1882.

Pleased to hear good news from Boston; just returned from Washington, leaving the national capital flooded with electric light; halls and art galleries illuminated; thousands are viewing it, all pronouncing it a grand success. Government going to adopt it. Things booming all along the line.

"Now," continued Mr. Goff, when he had finished reading the telegram, "I don't hesitate to say that, when I read that telegram, I didn't believe it. So, on Saturday, April 1, I wrote to Col. Hooker, at Washington, inclosing a copy of the telegram, and asking him to acquaint me of the true facts in the case. Monday following I received the following telegram from Hooker:

Washington, D. C., April 3, 1882.

No electric lights in the Capitol or art gallery at present. Are putting in wires to exhibit in basement of Capitol in few days.

"When this telegram came from Hooker, Hersey, Haldeman and myself immediately held a consultation, and determined that, as it was patent a fraud had been perpetrated on us, we must get out of the company at once. On Saturday, April 1, by the way, I had received by letter Fred Grant's resignation as president and director. To him I sent this reply:

April 3, 1882.

Col. Fred Grant, No. 3 Wall Street, New York: Your letter of resignation received, and will be acted upon at next directors' meeting. Personally, I protest, considering you and your associates responsible for inducing me to go into the company.

Edward H. Goff.

"To E. M. Fox and George Crosby, on the same day, I sent a telegram, of which this is a copy:

Boston, April 3, 1882.

Grant has sent resignation as president and director, and insists upon immediate acceptance. We also learn that your telegram regarding lights in Washington is untrue. Therefore Hersey and others refuse to act longer as officials of the company. I see no other alternative but to resign and state the whole facts. I cannot, in justice to myself and others concerned, do otherwise. What have you to say?

"Now here is an exact copy of the insulting answer sent shortly by Crosby:

New York, April 3.

Have this to say: That my wire to you from Washington was true, and that, whoever says to the contrary lies; if you say so, you lie. You have played your game of bluff long enough. There is a day of reckoning coming with you. From all I can learn you have carried on a worse game than the Boston Ships Berth Company, and the stockholders are going to look into your dealings.

"My answer to this telegram was immediate and decisive, and read thus:

Boston, April 3, 1882.

Mr. Crosby's telegram received and placed in the hands of our attorney, together with other telegrams and papers which will show, if made public, who has been playing bluff. My informant from Washington cannot be disputed. Your abusive language renders further business relations impossible.

"After this we immediately notified other parties interested in New York that we could have

NOTHING MORE TO DO

with the company and had resigned. At the same time we sent a letter to Col. Fred Grant, of which the following is a copy:

Col. Fred Grant, Wall street, N. Y.: Your communication addressed to the board of directors duly received and placed on file. Since that time several other directors have signified their intention to resign, and have sent them in. Of course, if all resign, they cannot be acted upon and others appointed to fill their places, and I would therefore suggest that you indicate a time at which you could be present at a directors' meeting and authorize the secretary to call the same. E. H. Goff, Vice-president.

"To this I have received no reply, and the resignations all stand, like the company itself, in statu quo. Messrs. Hersey, Haldeman and myself ceased acting for the company immediately after the telegram of April 3, and so notified every one here who was doing any business with it. We then, after selling out the lease of the Tremont street store, moved up stairs and, in our new apartments, began the formation of a new company, as we have no intention of going out of the electric light business.

After describing, in quite hopeful terms, the prospectus, patents, etc., of the new company, Mr. Goff continued: "We have, while organizing the new company, determined, though not legally liable for $1 of the $15,000 debts of the old one, that we shall protect the interests of every holder of stock which has been purchased through our influence or agency, and are now using our efforts with that object in view. The officers of the new company have not yet been chosen, but will be soon; this company, I want to say, is organized on what we consider a sound basis, with enough cash and capital stock in its treasury to keep that basis sound. We have, through our connection with the old company, and its final collapse, suffered an extremely mortifying experience, and it has been our disposition to say nothing about our loss until the knowledge of recent hard criticisms has reached us. So we made this statement as justifying our position in the matter."

This was the formal statement made by Mr. Goff, in the course of a protracted interview and as, when the conversation was nearly concluded, Maj. C. S. Haldeman, general manager of the collapsed company, entered the room, the statement was read to him and by him approved, as far as concerned his relations with the company. He, like Mr. Goff, had been entirely "taken in" by the brilliant representations so unscrupulously set forth by the New York parties. He was inclined to think

FRED GRANT'S CONNECTION

with the company was in the nature of a "middle" party; in other words, that he (Grant) had, like others, been duped by the Fox-Crosby-McMahon gang.

Regarding the sales of the stock in this city, inquiry at Fogg Bros. & Co.'s, the agents, developed the fact, given on the authority of Mr. John S. Fogg, that his firm had sold but 23 shares at 115. Mr. Fogg said he knew little about the company, had advised purchasers of stock very guardedly and was positive 23 shares comprised the extent of his sales. Mr. Hersey was the gentleman who first called Mr. Fogg's attention to the company.

Another broker, reported on the street to have sold a large number of shares, said, laughingly, that the rumor was quite false; that he hadn't sold a share, not because he hadn't tried to, but because he couldn't find customers. The reputation of one of the men connected with the affair (Mr. Goff) was very unsavory, this broker held.

Mr. R. H. Whitney, another broker who was reported as having made large sales of the stock under market prices, in the interests of the New Yorkers, said last night that he had really sold only 15 or 18 shares at 100. The stock had been brought to him by parties who, he supposed, had bought it from other parties and wished to get rid of it. He held himself 150 shares, which he had obtained from Mr. Chaffee of the Collateral Loan Company, Mr. Chaffee, in turn, having received the stock from James W. Fox, one of Gen. Butler's partners, and whose dealings in electric light securities seem to be, in various ways, closely connected with the present case.

A Tremont street merchant, who invested in five shares at 100 on the representations of Mr. Hastings, tried to sell two days afterward, and found, to his amazement, no one willing to purchase at any figure.

The entire sales negotiated by Messrs. Goff, Hersey, Hastings and others of the company, Mr. Goff claims not to have exceeded 150, sold at a figure ranging from 90 to 115. Of this not a share was treasury stock, but belonged to the New York parties, so that the capital stock of the company is still intact, and, with its charter, is waiting for the New Yorkers to come on and finish up their affairs.

Mr. William McMahon, who was in the city last night, said that he was here for the purpose of looking into this matter, and fixing the responsibility where it belonged. He claimed that the sales of stock by the Boston parties amounted to $70,000 or $80,000. Mr. McMahon, evidently, can unfold a tale when he chooses which may throw more light on what is certainly a complicated swindle of the first water.

Hon. P. A. Collins, whose connection with the company in its early period, and subsequent appearance in other matters of the company, were referred to by various parties interviewed, was sought for last night, but without success. There are yet many developments to be made in the case, which promises to turn out racy in every sense of the word.

Stephen Moriarity's Statement.

[Special Dispatch to the Herald.]

NEW YORK, April 22, 1882. Questioned to-night about a report that the electric light company, of which Fred Grant is president, had failed, Mr. Stephen Moriarity, a former director and still a stockholder in the company, said that the company had sold a franchise for Massachusetts for a stipulated sum to a number of Boston capitalists, who had represented themselves as men of means. They organized under the name of the American Electric Light Company of Massachusetts, and Fred Grant, who is a director of the mother company in this city, was chosen temporary president and acted in that capacity for one day. Further organization of the Boston branch, however, was put an end to by the failure of the Boston capitalists to make the promised payments, and, accordingly, the project fell through. The failure of the company to organize, Mr. Moriarity said, was due to the Boston incorporators making promises that they could not fulfil. Mr. Moriarity is still hopeful of the success of the New York company. "We are young men yet," he said, "but we make a good light, and it will not always shine under a bushel."

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New York Times
12 Apr 27 1882

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ELECTRIC LIGHT MONOPOLY

THE EDISON COMPANY JOINS THE GRAMME COMBINATION.

A POWERFUL AND RICH ORGANIZATION—THE OWNERSHIP OF ALL ELECTRIC LIGHT PATENTS CLAIMED — VICE-PRESIDENT EATON'S STATEMENT.

One of the most gigantic monopolies of the age has been created by the union of the Edison Electric Light Company with the Gramme Electrical Company on the 22d of last month. By this combination the several large companies that claim to control all of the patents applying to existing systems of lighting by electricity are formed into one monster organization. The Gramme Company was established in the latter part of April, 1881, and, prior to the joining of the Edison Company, was composed of the American Electric Company, of New-Britain, Conn., the Brush Electric Company, the Fuller Electrical Company, the Jablochkoff Electric Lighting Company, the United States Electric Lighting Company, and the Weston Electric Light Company. All of these companies were possessed of valuable patents, and were supposed to be backed by ample means. So strong, in fact, did the Gramme Company consider itself that it announced, by circular, that the patents owned by its members covered "the fundamental principles involved in all the existing systems of lighting by electricity and cannot be successfully avoided by outside companies." As the Edison Company was at that time one of the "outside companies" it might reasonably be inferred that the language of the circular was directed at that company as well as to smaller and much less powerful organizations.

The first annual meeting of the Board of Trustees of the Gramme Electrical Company was held at the company's office in the Boreel Building, Broadway, on Tuesday afternoon and yesterday morning, and the first annual meeting of the stockholders of the same company was begun yesterday afternoon. Mr. Henry I. Hoyt, President of the Gramme Company, presided during the former meeting, and Major S. B. Eaton, Vice-President of the Edison Electric Light Company, was Chairman of the stockholders' meeting. The character of both meetings was more conversational than otherwise, the objects, prospects, and internal policy of the great organization being informally discussed. It was announced that among other topics brought up for consideration was the best methods to be pursued to gain public confidence in a responsible system of electrical lighting. The stockholders' meeting was attended by the following named gentlemen: Henry I. Hoyt, W. H. Appleton, R. B. Minturn, C. R. Flint, Col. R. R. Hazard, the Hon. M. D. Leggett, George W. Stockley, Major S. B. Eaton, C. Goddard, W. Parker, J. J. Skinner, W. M. Ivins, A. H. Chandler, C. A Cheever, and G. W. Hebard. The meeting was adjourned until 11 o'clock to-day, when, it is expected, there will be an election for officers.

Prior to this meeting it had not been generally known that the Edison Company had joined the Gramme Company, and upon THE TIMES's reporter expressing some surprise that such should be the case, President Hoyt promptly replied: "Oh, yes; the Edison Company are with us."

"How was the union brought about?" was the very natural inquiry.

"Well," said President Hoyt, "the Edison Company could not very well do anything else than come in. You see, the Gramme Electrical Company own patents that cover every system of electric lighting, and there is no company that would care to stand out against us." Mr. Hoyt then entered into an explanation of the extent, power, and purposes of the Gramme Company. He said that public confidence had been shaken in the electric light enterprises by the organization of "wild cat" stock companies, whose only object seemed to be to foist a lot of worthless stock upon a gullible public. Such companies were being organized all over the country. They owned no patents and were for the most part entirely irresponsible. Frequently they would buy machines from other companies merely to place on exhibition in order to secure a sale of their stock. "Why, Sir," exclaimed Mr. Hoyt, indignantly, "I have even had men come to me and ask to borrow dynamo-electric generators to exhibit in the offices of the so-called 'electric light companies.' Now, one of the chief objects of the Gramme Company is to stamp out all such fraudulent concerns. I have here a list of 40 or 50 of them, and the agents of our company keep themselves thoroughly posted as to the movements of all such speculative enterprises. We shall endeavor [illegible] practicable as soon as possible. It is absolutely necessary to the success of the legitimate electric light companies that the public should be fully informed regarding the worthlessness of many enterprises in which they are invited to invest money." Other officers of the Gramme Company were enthusiastic in their assertions of what the extensive and influential organization proposed to do. It was believed that the several companies belonging to the Gramme would reap untold advantages. In the first place, uniformity of prices will be secured, more perfect harmony of action will exist, and the necessary litigation between the companies will be simplified and made much cheaper. As for outside companies it was declared that active steps will be taken to wipe out every electric light company in the country unless they should have something new and worthy of consideration in the way of an electric light. The statement is also made that there is probably not a patent lawyer in the country of any prominence or special ability who is not engaged in the interests of the Gramme Company.

Major S. B. Eaton, the Vice-President of the Edison Electric Light Company, was called upon at his office by a TIMES reporter and asked if he would explain why the Edison Company joined the Gramme Electrical Company. He replied: "As long ago as last August a committee representing the Gramme Company and a committee from our own company were appointed to confer as to our joining the Gramme organization. Those committees continued their conferences until recently, when, agreeable arrangements having been made satisfactory to the Gramme Company and its constituents, we, on March 22, became members of that organization. As regards the Gramme Company's patents, our present attitude is just what it has always been, viz., that we do not use the Gramme machine, and that the Edison machine in no sense whatever infringes the Gramme patents. Our reasons for joining the Gramme Company had nothing to do with the Gramme patents. We desired to avail ourselves of the advantages of a business organization controlled by people engaged in enterprises similar to ours, and united to promote harmony, uniformity of prices, and simplicity of litigation, and also to prevent the public from being imposed upon by new companies without patents and without integrity. A very important consideration with us was that we wished to avoid being hectored by every new company that unprincipled parties disposed to steal our inventions might get up. Such companies spring up daily. It is one of the functions of the Gramme Company to strangle all such organizations, and we would gladly join the Gramme Company just for that one convenience of having somebody else take off our hands the tiresome and expensive task of putting so many other combinations to death."

"Could the Edison company have prosecuted its business successfully had it remained independent of the Gramme Company?"

"There is no reason at all why it should not have been able to do so. The Edison Company is devoted exclusively to incandescent lighting, and all of the other companies composing the Gramme combination are, with a single exception, devoted exclusively to arc lighting. The patents possessed by the arc-lighting companies have nothing whatever to do with our business, the two systems of illumination being totally unlike. The company referred to as the exception is the United States Company, which owns the Maxim incandescent light, and I have never heard any one say—not even the Maxim people themselves—that our patents infringe upon theirs. The real issue between the Edison and Maxim people is that the latter's lamp is a square infringement upon Mr. Edison's."

"Had your company been threatened with prosecution for infringing patents held by the Gramme Company prior to your joining that organization?"

"No, Sir. Our company has never been sued nor threatened with suit either by the Gramme Company nor by any member of the Gramme Company. Nor have we been sued or threatened with suit by any other company or inventor. We are the people to do the suing, as with reference to incandescent lighting we have exclusive ownership. In our suing processes we shall enjoy certain advantages by being members of the Gramme Company. In that company are three important committees, viz., a Committee on Shortening and Cheapening Litigation, a Committee on Harmony, and a Committee on Prices. It is the duty of the first named committee to simplify all litigation and, if possible, to harmonize the differences. At any rate, all litigation between the companies in the Gramme will be tried by reference before skilled men without going into court. The Committee on Prices will see to it that each company shall sell the same quality of goods at uniform prices."

"The Gramme Company is destined to become an absolute monopoly in electric lighting, is it not?"

"Yes," was the answer, "the company had a monopoly of arc lighting before, and now that they have got us in, they have a monopoly of incandescent lighting as well."

"How much capital is represented in the Gramme Company?"

"That is something I cannot tell you at present. I might by figuring up the value of the stock of each company interested."

"It amounts to a great many millions of dollars does it not?" asked the reporter.

"Yes; the stock of the Edison Company alone is worth $5,000,000."

The Gramme Electrical Company will probably settle upon some definite line of policy at the meeting to-day. Notice is given in their circular that "all parties manufacturing, selling, using, or having in their possession electrical apparatus which infringes the patents of the Gramme Electrical Company will be prosecuted to the fullest extent [illegible]."

St. Louis Post-Dispatch.
May 1, 1882.

THE DOOM OF GAS.

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What Edison Has Accomplished to Perfect Electricity.

New York City Soon to be Generally Illuminated by Electric Light.

Millions of Sewing Machines to be Run For Five Cents a Day Per Machine.

Interesting Interview with the Great Inventor About His Plans and the Future.

How He Has Worked Twenty Hours Out of Twenty-four to Master Every Detail and Overcome Every Difficulty.

About One Thousand Millions of Dollars Invested in Gas Stocks, and Their Enormous Profits.

In New York the Profits Amount to $4,000,000 Per Year—In St. Louis to Over $600,000—$50 Shares Sold at $315—How Edison Looks and Talks—What He Proposes to Do for St. Louis—Our Local Monopolies.

Special Correspondence of the Post-Dispatch.

NEW YORK, April 27, 1882.—Is the electric light cheaper than gas? Can it supplant gas as a cheaper means of general illumination? These are questions which the public, judging from the great advance in gas stocks, have generally answered in the negative, and not a few have declared that the electric light was therefore a failure. But Mr. Edison, in the interview which follows, insists that he will compete successfully with gas and within a few years drive gas as a means of illumination out of existence, and he says his experience in the district which he is now about to light up between Spruce street (the Tribune building), Nassau, Wall and the East River, will

abundantly prove this. Mr. Edison has been quite ill at the Everett House for a couple of weeks, but yesterday was well enough to sit up in an easy-chair and to chat on the subject of the impending battle between the electric light and gas. What a wonderful amount of nervous energy there is in this man, who knows not what it is to have dyspepsia, though he almost lives on pie, who says he has no beard because he pulls out the hair roots of his mustache and is always tugging away at his eyebrows, and whose eyes are so continually changing in color that one man says they are hazel-brown, the other blue, the other gray, while he himself declares he doesn't know what color they are. "Sea green!" declared the [illegible] inquisitor, after noting their rapid change from dark blue to a light greyish or greenish hue, and Mr. Edison laughingly consented. With his smooth, thin, wan faces sharp, decided, strong features and light brown hair, prematurely tinged with slight streaks of gray, Edison makes upon one the impression of a man who has put seventy years' work into the thirty-five which he has lived, and yet there is a quickness and lightness about his manner which is almost juvenile, and his utter beardlessness make, him look (when the treacherous gray of his hair is covered by his hat) younger still. Mr. Edison comes of old Dutch stock on the one side—he remembers hearing his grandfather talk Dutch—and of Scotch on the other. One of his oddest traits, beside his pie-eating, is that he says he never can reflect in bed; he always thinks out his great inventions amid a clatter of tongues around him. The first question asked Mr. Edison was whether it was true that Mr. Vanderbilt had his electric lights taken out of his new house because they did not work well and because they had set fire to the woodwork, as some of the gas people had stated.

THE LIGHTS IN VANDERBILT'S HOUSE.

"It is false," Mr. Edison replied, pulling together his open vest. "He never tried our light. We have wired his house for lighting it from our station, in the way of general distribution; but he thought he would rather not wait till we came along there, and preferred to have an isolated plant himself. The first night on which the engine ran it made a noise, as all new engines will, and Mrs. Vanderbilt complained of it, and that settled it."

"How about the alleged setting fire to the woodwork?"

"There is nothing in it except just this: In running temporary wires in different directions just to show Mr. Vanderbilt the effects, one of them came in contact with a burglar-alarm wire, and this one, being overheated, charred some of the gold-thread wires of the cloth wall-paper which it ran into—that is all."

The questioner now turned to the main purpose of the interview, the cheapness of the electric light.

"The best answer to that question is that we are going to sell the light as cheaply as gas," Mr. Edison replied. "There are 16,000 gas jets in this first district which we shall commence lighting up within a couple of months, and we have arranged to light all these 16,000 lamps, with the exception of 850. We have got written agreements with ninety-three per cent of the gas consumers in this district that they will take the light, provided we furnish it at a price not to exceed their gas-bills."

"And who is to decide what these bills were? Have you seen them?"

"Yes; we have taken copies of them all; we have got twenty-four books containing these records."

"What will be your investment per 1,000 feet of gas in the electric light plant?"

"Ah," exclaimed Edison laughingly, "that's coming home pretty closely." After a little reflection he added, apparently still amused at what he called the "closeness" of the question: "Well, I'll tell you. Our investment will be $3 75 per 1,000 feet."

"And what is the investment for gas?"

Edison, who appeared to have the figures at his fingers' end, said, "$3 75 per 1,000 feet."

"Do you include in these figures everything except running expenses (coal, lamps and wages) and depreciation of the plant?"

"Certainly. My real estate investment is smaller than theirs. We can have our stations in the back slums, and don't want so much room. I can put all my works to light up the city of New York inside the gasometers of the Manhattan Gas Company. For instance, our outside pipes, which are full of an insulating material, will last fifty years, while gas pipes rot in twenty years, and our copper rods (wires) will last forever. The depreciation in our dynamos is not over one per cent per annum."

THE LOWEST COST OF GAS.

"Do you know precisely how low the companies can make gas?"

"Precisely," Edison retorted. "I have gathered the statistics for years past. In New York the gas in the gasometer costs them 45 cents per 1,000 feet, and the expense of distributing, collections, legal and other items make up 45 cents more, so that it costs 90 cents altogether, and for this they get $2 25 from the consumers."

"In saying that it costs 45 cents in the gasometer, do you allow for their sales of ammonia, coke and tar?"

"For every cent they realize in that way. At 90 cents, if they retain all their present consumers, they can't make any money—not a cent."

"Well, supposing they put it down to $1 per 1,000 feet just to crush you, what then? Can you compete with them at that figure?"

"I'll tell you exactly what my ideas are," Edison replied, with great energy "We are not going to charge less than $1 50 for our light, equivalent to 1,000 feet of gas, even if they put it down to $1. Electric light is commercially worth 50 cents more than gas, because it is a better, cleaner, purer and more wholesome light, giving out almost no heat."

"You might then have to compete at $1 50 as against their 90 cent rate?"

"Oh, no," Edison cried, his eyes lighting up shrewdly. "It only costs them 90 cents with their present custom at their present output. At $1 50 I should certainly take away one-half of their consumers, and when I have reduced their output one half, I have very carefully figured out that their gas will cost them $1 23 per 1,000 feet."

"But the gas companies are rich—"

"No, they aren't," Edison interrupted. "They have paid out all their gains in big dividends. They haven't accumulated any large surplus."

EDISON'S LOWEST CHARGE FOR THE LIGHT.

"In any case, supposing they put gas down lower still, what then?"

"I can say right here that even if they put it down to one cent per 1,000 feet we shan't charge less than $1 50, for our light is so superior that we should get a large number of their consumers anyhow; and," he added, with a twinkling eye and a grimly humorous smile, "they aren't so anxious to be bankrupted in a few years. They'll look out fast enough for number one."

"What will the cost of the light be, taking your first district? For instance, can you give me a detailed official estimate of the various items of cost?"

This innocent query made Edison laugh heartily for several minutes. "I say," he finally responded, comically, "you have mistaken your vocation; you ought to be a cross-examiner. Do you think that we want the Legislature after us the moment we have got started reducing our rates? We are not going to lose any money, that you may depend on, or else we shouldn't be going into the business."

"How can you compete with gas in England, where it is sold as low as 45 cents per 1,000 feet?"

"Ah, that is in Leeds and right in the coal fields, where it is sold by the city corporation themselves and is used in immense quantities. The average charge in London is 87½ cents, and many companies in England charge $1 25 and more. Some of the small companies charge as much as $3 45."

"Why is the cost of gas so much lower in Europe than in this country?"

"The cost of the machinery and the entire plant is much less and wages are much lower. Everything is lower, in fact."

"But not in the extraordinary proportion of the difference in the cost of gas, as between London and New York, for instance—between 87½ cents and $2 25?"

"Well, that is accounted for also by the far greater consumption of gas in dark and foggy London. Remember, the more gas you sell in a given district, made by one plant, the bigger your profits. Supposing I were to light up a square mile in London I'd sell three times as much light there as in New York, on account of the large day consumption there."

"But, taking the comparative cost of your plant, wages, etc., where will you make the most money, in this country or in Europe?"

"Oh, here," Edison replied, with a broad smile of pleasurable anticipation. "The gas business in England; in Germany, where they charge from $1 25 to $1 75; in France, where they charge about $1 50, and in the other European countries, is a very fat thing, but nothing like as fat as it is here." (Edison pronounced the word "fat" with a funny unction which showed that he appreciated the "fatness" of big profits.) "In this country it's a perfect bonanza, and, though we can successfully compete with the gas companies in every country in Europe, we shall make more money with the electric light right in this country than anywhere else."

"But can you tell yourself what precisely it will cost?"

"Why can't I?" Edison queried. "I've got all my plant, bought the land, erected the building, put up the boilers, engines and dynamos. I know what we shall have to spend on coal, lamps and wages of employes—why shouldn't I be able to tell it?"

"You have never yet made it on a sufficiently large scale, have you, and never for house-to house distribution?"

"We have been making the light for two years. We have the isolated lights in 200 different places running successfully in this country, besides having it at La Scala in Milan, in Finland, in Santiago (Chili); Strasburg, and almost every country in the world. And for the last two weeks we have had a station running in London, just as this one will be, at the Holborn viaduct, for house-to-house distribution from street pipes, and all the stores, churches, hotels, etc., within half a mile are being successfully lit up. Dr. Parker's church has 170 lights. The station runs over 1,000 lights successfully, and if they had found that they couldn't do it at a profit and that it was a failure, I should certainly have heard of it by cable before this."

PROFITS OF ELECTRIC LIGHTING.

"You say that your total investment will be $3 75 per 1,000 feet. For that you will get $2 25 per annum or 60 per cent, if you charge as much as the gas companies do. Isn't that rather high, Mr. Edison?"

"There he is again," Edison broke out, laughingly. "Isn't he a sharp one to ask questions? My dear boy, the $3 75 is our investment in plant—of course, that don't include coal, lamps, wages and the operating expenses generally."

"How about your coal consumption—how will that compare with that of the gas companies?"

"Oh!" Edison exclaimed with a triumphant wink and a pleasant smile, "we'll burn $3 anthracite slab coal, and theirs is $5 gas coal."

The delighted emphasis which Edison put on the "$5 gas coal" showed that he regarded this point as a "clincher."

"And how much light will you get out of your coal as compared with the gas companies?"

"They get five feet of gas out of one pound of coal, but as they realize 60 per cent of the cost of the coal from their by-product, they really get ten feet out of their $5—gas coal."

"And you?"

"We get a little more—11¾ feet—out of our $3 coal. You see, 3½ pounds of coal gives me one horse power, which runs 8 lights of 16 candle power each. Now, each light is equal to 5 feet of gas, which would give me light equivalent to 40 feet of gas for my 3½ pounds of coal. That's 11¾ feet per pound, ain't it?" Edison queried, Yankeewise.

"How many people will it take to run your first station?"

Edison laughed again and, after some hesitation, said, "Fourteen."

"How will their work be subdivided?"

More hilarity on the part of the good-humored inventor, but after some cross-questioning, to which he gracefully submitted, this was the list of employes for the first district which he furnished:

ELECTRIC LIGHT EMPLOYES.

Engineers, 2; firemen, 4; metermen, 3; collector, 1; regulator for pressure, 1; boy for supplying lamps, 1; superintendent, 1; assistant superintendent, 1.

"In your calculation you speak of light equivalent to 1,000 feet. What do you mean by that, Mr. Edison?"

"Well, we know that 1,000 feet of gas gives the light of so many standard or 'parliamentary' candles, as they are called. Experience shows that the result per hour varies from 1,800 to 3,000 candles, depending somewhat on the quality of the gas and the state of the burners. Now we give a uniform, unvarying light of 3,000 candles as our standard basis of 1,000 feet of gas. Our customers won't get 1,800 to-day and 3,000 to-morrow. They will always get 3,000 candles. That will be our basis."

"What is the gas business in New York worth? What are the combined gas stocks selling at?"

"I will give you the very last figures from the Gas Light Journal." Mr. Edison did a little lightning calculation and gave this to be the result: Total nominal capital of the New York gas companies $19,500,000. Total selling price of stock at last quotations, $10,000,000.

"And how do you account for the high prices of the gas stocks if the industry is doomed to destruction?"

"Because they are still paying big dividends and we are not yet in operation. But just wait till they see that we are running 10,000 lights successfully!"

"How many gas jets are there daily burning in New York City?"

Edison calculated awhile and then said: "About 800,000."

"And you expect to supplant all these 800,000 by so using electric lamps?"

"Certainly; within ten years I believe that gas will practically be extinct in New York except for heating. But the gas stocks won't keep up over two or three years. People will see that while they may be contending to receive big dividends for three or four years, yet their capital is dwindling away all the time—namely, their custom, their business."

"Even in tenement houses you expect to do this?"

"Yes, we can afford to run one light in a house even. Of course, many of the tenement houses have kerosene, which costs only sixty cents for the light equivalent to 1,000 feet of gas, and we now address ourselves most to the people who now find it to their taste to pay $1 65 more per 1,000 feet for a better light, for gas. But there again, we shall make a mint of money by selling power to run sewing machines, just as we shall use our electricity all day in the down town district for running machinery."

"Oh," Edison declared, in a tone of deep conviction, "with what we can make in selling power into the bargain they can't compete with us—they can't do it," and he reiterated the conclusion in a tone of the most absolute conviction."

THE NEXT DISTRICT TO BE LIT UP.

"When will you begin work on your second district?"

"Immediately. Our second district to be lit up will be that bounded by Twenty-fourth and Thirty-fourth streets, and Eighth and Madison avenues. This is one of the most profitable gas districts in the city. There are 42,000 gas jets in it, and we shall have it lit up this summer. We shall also find here 4,400 sewing machines to run.

"Mr. Edison, you say that gas is henceforth doomed as a light. Please give me your reasons for that opinion."

Mr. Edison, who had hitherto maintained a chatty, colloquial tone, now became more formal and said: "Gas is a barbarous and wasteful light. It is a light for the dark ages. The distribution of gas through a city is done by means of an immense system of sewerage pipe, through which it is forced and kept under pressure—a gas reeking with impure material and made by a dozen different processes. This gas is allowed to escape through holes into our apartments where it is burnt, taking oxygen from the air to support combustion, the products of which are carbonic acid, carbonic oxide, sulphuric acid, sulphuretted hydrogen, and a host of other substances, which vitiate the atmosphere. It thus gives 93½ per cent more heat than light. In fact the result of the vile poison is almost entirely heat and only incidentally a little light. It is a nasty, yellow light, too, and far removed from the color of the lovely natural light. And it is charged for by quantity and not by quality, for it is passed through meters which measure the quantity and not the quality of the light—certainly a wrong system. At the source of supply the crude material from which this gas is made, namely, the coal, is passed through a distillation process, from which it is liberated from the other constituents of the coal, more or less imperfectly. It is then stowed in the gasometer ready for distribution. This is one half of the process. The other and final portion of the process takes place in our sitting and bed-rooms, much to the detriment of our health, our sight and our household effects. In other words, matter is sent into dwellings for the ostensible purpose of producing light, whereas its main product is heat."

"Well, how as to the manufacture of the electric light, Mr. Edison?"

"In the case of the electric light nothing is sent into the house but energy whereby the light is produced and a very small amount of heat, about 6½ per cent as compared with the amount of light. It does not flicker, it does not vitiate the atmosphere. It shows colors in their natural hues and does not hurt the eye. The meter measures quality and quantity both."

THE MONEY NECESSARY TO INTRODUCE IT.

"How much money will be required to introduce the electric light all over New York?"

"It will take about twelve million dollars to install my light throughout New York City. It will take just about three-fourths of the actual money invested in gas, which is about $16,000,000."

MONEY INVESTED IN GAS.

"How much money will it take to introduce the electric light all over the world?"

"Oh, that's hard to tell. What we do know is that there are about $385,000,000 invested in gas in the United States, and about $405,000,000 in England. According to the London Gas-Light Journal, there are about one thousand millions of dollars invested in gas throughout the world, while there is only seven times that amount invested in railroads—so you see what a gigantic industry it is. There are only about two hundred million dollars invested in telegraphs and cables and only seven millions in telephones. The telephones, as investments, pay best of all."

"What guarantee will electric light consumers have that the light won't go out?"

"In all central stations we shall have twelve separate steam dynamos, and we shall never use more than ten at any one time. When we shall have three districts started, if the central station belonging to one should burn down, the other two central stations will supply the three districts. In fact there will be far less chance of our light giving out than is the case now with gas, which occasionally does go out. I have heard of as many as 150 people complaining at a gas company's office in one afternoon during very cold weather that they have got no gas and can't get any."

PROFITS OF THE GAS BUSINESS.

"For the $12,000,000 to be invested here in electric lighting, how large a return do you expect to get?"

"Mr. Edison's eyes twinkled again, but he finally said: "Well, the Gas Companies in New York City make about $4,000,000 net per annum. They sell 3,850,000 'm's' (1,000 feet) every year, for which they get $2.25 each, or $8,662,500 in all, and more than half of this is profit. That's what they make. What we'll make it is perhaps premature to say, but whenever in competition with gas we shall come down in our price to a point that will prevent the gas companies from clearing any money whatever, we shall still be earning profits, making our stock as valuable as the gas stocks are to-day, when the gas companies have no competition at all."

WATER GAS.

"Is water gas as deleterious as coal gas?"

"Much worse, owing to the large proportion of carbonic oxide—which is a blood poison—contained in it. I would just as lief have sewer gas come into my room as water gas; just as lief."

"How cheaply will you be able to run the sewing machines?"

"We can run a sewing machine all day long, at a cost to the consumer of five cents. It takes the same amount of electricity to run a sewing machine as it does to light a lamp giving sixteen candles. We can subdivide the electric motor down to one-hundredth of a horse-power. There are in New York 210,000 sewing machines and there is no reason why we should not supply power to run most of these. Of course in the tenement-house districts our business will be simply enormous."

MR. EDISON'S OPINION OF GAS MEN.

"What do you think of the gas people generally?"

"I have a very poor opinion of the men generally engaged in the gas business. Like all large corporations making very large profits, any mismanagement is never inquired into as long as the company pays fat dividends, and of all the corporations in the United States the gas companies are those most grossly mismanaged. For years they have been squeezing the public as they would a lemon."

"But if the electric light is such an invincible foe of gas, why haven't they bought it up?"

"They never thought that the thing could be done, and having so much interest in not having it done, they would not reason or listen to anything tending to show that it could be done, and, besides, they could never buy our company up any way."

This declaration appeared to imply a proclamation of unpurchasable virtue, and the question therefor suggested itself naturally:

"Why not?"

"Because the gas stocks are extremely subdivided as regards the holdings of the investors and are owned, generally speaking, in small lots, and the managers as a rule hold no very considerable or controlling amount of stock, so that there would be no concerted action. Indeed there has been no one among the rich gas stockholders to take the initiative in such an undertaking as buying up the Edison Company."

"In other words, as I understand you, gas, in your opinion, has no Commodore Vanderbilt—no Jay Gould?"

"No, certainly not. Gas has no bright, enterprising, 'live' men. The leading men in it are nearly all old fogies. Commodore Garrison is perhaps the richest and the searpest, but then he is a very feeble and very old man."

"Do you see now, after all the tests which you have made, any practical difficulty in the way of a successful operation, on a scale equal to that of gas, of the electric light?"

"Not the slightest difficulty occurs to me. There is not a single detail, however small, which gives me the slightest anxiety to-day. As we have progressed with the introduction of the system, however strange it may seem, the amount of money to be invested diminishes, the life and economy of the increase, and the margins for future improvement is so infinite that there is no telling how low lighting by electricity may be brought down to within the next ten years."

LIFE AND COST OF THE ELECTRIC LAMPS.

"What is now, after your very latest experience, the life of the lamp?"

"The average life of the lamp which we use for general distribution (allowing eight lamps of sixteen candles each per horse power) is about eleven hundred hours. The same lamp, one year ago, did not last six hundred hours."

"How would that practically work in New York?"

"The average burning time of a gas jet in New York is four hours per day, and at that rate a lamp would last 275 days."

"And where there are several lights?"

"Well, I have five gas-lights in this room, for instance, and if it were lighted by my lamps instead of these gas jets and I burned them four hours per day, I should have to put in a fresh lamp every fifty-five days. Of course in some places the average burning time is as much as five hours per day, and perhaps even more."

"Will you charge separately for your lamps?"

"No, we shall sell electricity by the meter, and the supply of lamps will be simply regarded by the company as an expense of the business. We shall give each consumers a box with a dozen lamps all complete for screwing on their burners whenever they should want them."

"Do you think you will increase the life of your lamps?"

"Within the next year I am confident I will get my lamps to average a life of 2,500 hours. I have had lamps last 9,000 hours of exactly the same make as those we are using, thus showing that it is possible to get all my lamps to last that time."

"This would make the light very cheap?"

"Certainly. Manufacturing these lamps by the million, as we shall—we have already made a quarter of a million of them—we can make them very cheaply indeed. The whole lamp, carbon, globe and socket tip for screwing on the burner, all complete, can be furnished by us at a small cost to the company. They shouldn't cost us, made on that great scale, over 50 cents a piece, though at retail we charge $1 for them now to people having isolated plants."

"You will manufacture the lamps at Newark in the future?"

"Yes, we shall start our manufactory at Newark in two weeks. We moved from Menlo Park for want of room. Here in Newark our building covers six acres, and we shall employ 1,600 men there when we are running at our full capacity. At the beginning we shall put 250 men on. When I started there were only three glass-blowers in the country who could be obtained. I have now taught already from forty to fifty, and shall have to teach the art of glass-blowing to several hundred. The making of these lamps, which embraces thirty five processes, is an entirely new industry, and it is no small task and requires a great deal of patience to teach all these men how to do the work." With a quizzical humor Edison added: "I tell you, Job got too much reputation on a small capital; he ought to have been down at Menlo Park."

"How many lamps will you be able to manufacture there?"

"Forty thousand a day or 12,000,000 per annum, taking 300 working days in the year. At the start we shall, however, manufacture only 5,000 per day; that will be enough for the beginning."

"MR. SWAN MAKES MY LIGHT."

"Your light is practically the same as that of Mr. Swan, which has been so successfully introduced in London; is it not?"

Edison replied laconically and, at the same time, somewhat scornfully: "Mr. Swan makes my light." He added: "There are only two forms of electric lighting—the incandescent and the Arc light. The incandescent light is mine." These last few words were given with marked emphasis, and there was a wealth of pride and conviction in the word "mine."

"Well, Mr. Edison, you have undertaken a great work, a work of many years."

"Oh, I'm young yet," Edison replied gayly, "and I think I have a few years yet before me. My grandfather died at the age of 103; my father is 78, and the youngest of four brothers." And Edison rather gleefully snickered at the pleasant prospect of a long life of hard work and endless new inventions in electricity.

"Then you hope to be able to see out the battle between gas and electric light?"

"Yes, I hope to do that," was the energetic reply.

"Isn't there a good deal of popular disappointment, however, at the slowness with which the invention has been put into practical use?"

"I know there is," Edison replied, "but why? Because people in this country are so unreasonable. The moment I declared that I had subdivided the light, everybody thought they ought to see the light burning in every house in New York within a few months. It's ridiculous. The newspapers came out and said the electric light was a failure because within six months or a year I hadn't started yet selling the light to everybody in New York. And yet as late as '79 all the distinguished witnesses testifying before the English Parliamentary committee pronounced the economical subdivision of the light a visionary dream."

"How much time should you have been reasonably allowed?"

"If I had worked in the ordinary way? If the electric light had needed the time which the invention of gas, the sewing machine, etc., needed before the public could use them? Ten or fifteen years. It is only our people who work eighteen or twenty hours a day, without ever taking a holiday."

"How much time have you really had already?"

"Well, my invention was not really completed till July, 1879, so that I haven't had three years yet, and here is an industry with $330,000,000 invested in it to be supplanted and driven out; a new industry to be established, in which the vast majority of employes had to be taught as apprentices. Why, it was ridiculous to conjecture to light up any part of New York before 1881 at the very least, and that would only have given me five years. I don't suppose there are over 100 glass blowers available for our work in the world, outside of those I have taught myself. Up to last March, when I came to New York, I have certainly averaged twenty hours of work per day, Sundays and holidays included."

"What do you usually take when you are worn out with work?"

"A glass of water or a glass of milk," was the dry reply. (This is no pun.)

"And your favorite sustenance?"

"Pastry, particularly apple pie," Edison said, looking up eagerly at Mrs. Edison, who at this moment entered smilingly with her pretty little girl. Edison's eager glance seemed to ask, "Is there any pie, my love?" But her pleasant shake of the head and irresponsive blank look gave the doleful reply, "None." And so Edison was left to muse on his glorious future, with millions of electric light profits dancing before his eyes, and on the delightful prospect of the next, good apple pie.

WHAT EDISON WILL DO IN ST. LOUIS.

The plans of Edison for St. Louis I have ascertained to be as follows: As soon as his first district in New York is lighted up—which will be a couple of months—he will be prepared to have a sub-company formed in St. Louis, which, he says, can put down the plant and light it up within six or nine months after. St. Louis, he says, will be a splendid field for the electric light, because it is such a smoky, dark town. The gas company there, he says, is a perfect bonanza, charging $3 50 per thousand feet. He fully expects to see the offices and houses of St. Louis lit up with it early next year.

PHIZZ.

The Profits on Gas.

The manufacture of gas has proved, in St. Louis at least, one of the most profitable industries which human ingenuity has yet found to busy itself with. The whole story is told in a paragraph when it is stated that the St. Louis Gas Light Company pays annually on a capital of $600,000 dividends amounting to $360,000, or sixty per cent of the investment. The Laclede Company, not so favored by Providence, pays ten per cent on its capital of $1,200,000 besides paying the eight per cent interest promptly on a bonded debt of $800,000, and the six per cent interest on a further funded debt of $300,000. In other words, profits enough are collected from the people in the Laclede Company's district to pay $120,000 dividends and $23,000 interest, a cheerful total of $202,000 netted after all the expenses of manufacture, clerk hire, collection and repairing are paid for. The $50 shares of the St. Louis Gas Light Company command in open market $315; the $100 shares of the Laclede are held at $117@120. These figures tell the whole story.

Assuming that the total production of the St. Louis Gas Light Company for 1881 will be 71,000,000 cubic feet, and of the Laclede 311,000,000 cubic feet, which are the figures given by the authorities, it is not a matter of much difficulty to understand how these great profits are produced. In the first place much of the manufactured gas is wasted, no matter how well the connections may be made. Leakage is admittedly an important offset, and a long series of careful experiments has convinced both companies that any calculation which does not allow 15 per cent for leakage will be erroneous.

Sixteen cents is paid by the St. Louis Gas Light Company for Pittsburg coal, but higher class coal is used; and in his careful investigation of this subject Col. Find has assumed twenty cents a bushel as a fair price for the coal used. To make a million cubic feet of gas requires—

General office expenses	$ 20
Coal	490
Lime	86
Labor	270
Station works repairs	46
Coal expenses	15
Water license	8
Taxes	57
Repairing mains	10
Sundries	14
Total	$496

From this, however, must be deducted the incidental proceeds of gas making, which are, to a million feet:

Coke	$133
Tar	22
Ammonia	10
Total	$165

This leaves the net cost of 1,000,000 cubic feet of gas in the holder $791. Deduct 15 per cent for leakage and only 850,000 feet can be sold, costing $791, whence 1,000,000 feet ready for sale costs $930, or each 1,000 feet sold costs 93 cents.

The cost of lighting and repairing each lamp in the city is $1 80 per annum, and each burns 13,000 feet; hence 37 cents must be added to get the cost of delivery of this light in the lamps, making it $1 30 per thousand. It costs the company $16 90 to light a lamp a year. The city pays the company a profit of $20 10 on each lamp. The whole cost of delivering gas to the consumer, including collection, meter repairs and meter service, is 13 cents per 100 feet, hence the total cost of the article sold the consumer is $1 06. Deducting this from $2 50, the amount charged, we find a profit of $1 44 on each thousand feet sold. A discount is given for prompt payment, which is very variable and hence cannot be estimated as a constant factor, but which certainly strikes at this profit. In 1880 the St. Louis Gas Light Company made $74,370 profit on lamps and $375,500 profit on gas sold to consumers, a handsome total of $491,870 profit. The total profits of the Laclede Company for the same year were over $300,000.

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Mr. Edison and his colleagues in scientific invention have succeeded at last in "magnetising" our Stock Exchange. There has been a fever, a furore, a passion, a mania for lighting the whole world up with the electric lamp; company after company is springing into existence with projects more or less wide-reaching, and the "cry is still, 'They come.'" They cannot follow each other fast enough, it appears, for the public appetite, since shares are scarcely allotted before they fly up to an astounding premium, and the market a day or two since presented the phenomenon of electric scrip on which four pounds had been paid quoted above thirty, and ten-pound paid shares selling for sixty. The phraseology of electrical invention, which was but yesterday confined to savants and the laboratory, is becoming familiar as household words. Men run about with nothing on their lips save the "arc light" and the "incandescent light;" "Brush" has become a name to conjure with; and everybody hears and talks about the "Swan," the "Pilsen," and the "Standard." In the case of one new scheme brought out recently, on the day appointed for subscriptions, at a certain bank in the City, it is currently rumoured that the crowd of applicants for shares blocked up the approaches to the counter. In France a queue would have been formed, and people would have taken their turn; but the British speculator—with a fortune in view—"goes to the front." Many persons who could not get there were seen to twist their letter of request and the cheque inside it into a ball of paper, and, flinging the missile over the heads of the serried mass in front, go away without even awaiting a receipt. An electrical epoch would seem to have begun all over the Empire—for projectors declare their intention to illuminate India and the Colonies as well as the United Kingdom. Apparently they mean indeed to "light up mankind from China to Peru," and the movement reminds the observer in many respects of the great railway excitement fifty years ago when George Hudson was King. It is naturally on a smaller scale, because lamp-lighting is an easier affair than railway-making; but already a vast sum is pledged to these various undertakings, new industries are arising everywhere to supply them, and speculators think and speak of little except electricity, while the public heartily encourages them. No doubt the public is right; it is always wiser than any individual guide; it knows more and foresees better than many who assume to teach it; and, while the electricians were merely experimenting, it held its peace and watched. Proof after proof, however, was furnished that the electric lamp was to be a success; street after street and edifice after edifice were flooded with that lovely beam which is so bright and beautiful that its enemies admire while they abuse it. The show at Paris, followed by the splendid exhibition at the Crystal Palace, demonstrated that the electric lamp must and would be the light of the future, and the only questions remaining are of improvement in details, methods, and supply. It is a sound instinct, therefore, which tells the public that the time is arrived to "go in" for electricity.

Prudent persons will, as usual, reap the fruit of their caution and acumen, while the impetuous will burn their fingers. There will be the usual wild failures mingling with many solid successes—the inevitable "ups and downs"—before the new enterprises settle, like their forerunners the railway companies, into a career of quiet, profitable business and utility. Out of the financial flurry, however, will surely spring a wide establishment of the electric light for public and private service. There will be thousands and millions of the bright jewels of magnetic lustre where now we count them by dozens; and, just as railways thrust out of general use the slow stage-coach, or lucifers the clumsy brimstone-match, so this new friend of man, the "delicate Ariel" of electricity, will abolish the lurid, foul, unwholesome, and costly gas, and give us "daylight by night" which will not poison the air, or encumber and disfigure the roadways, or ruin the books, the pictures, and the health of householders.

Gas cannot believe all this as yet. Our already old-fashioned servant has been so long master that its yellow eyes blink and wink at the silvery rays of its rival, refusing to understand that its day is over. Gas thinks that, being so firmly and universally established, it cannot be dispensed with, and talks, with natural persistence, of its "convenience, manageability, and comfort." If the worst should arrive, it says that electrical wires can best be supplied by gas-engines, and hopes to rule in country places and in private houses, when it is deposed from streets, and public buildings, and factories. Alas for gas! These are such dreams as the old oil-lamps and the antiquated stage-coaches cherished. Its days are indubitably numbered; for, though the Ariel of electricity may make some use at first of the gas-pipes, as a sort of rough "slave of the lamp," the time will quickly arrive when not only every steam-engine will lend its spare force to illuminate our factories, but the winds, the currents, every running stream and every rising tide will be pressed into the service of the "tricksy spirit." When the light aerial lines of the new illuminating agent are stretched everywhere, who will tolerate the constant disturbance of our streets for repair of pipes, the recurrent explosions, the dubious gas-meters, the heavy quarterly bill, the blackened ceilings, and the damaged atmosphere? Gas stoutly answers that the electric lamp will kill us by shocks, burn us by sudden conflagrations, fail when we need it most, and cost more than the gasometers. All this, we are obliged to declare, is the complaint of George Stephenson's "coo" against the coming locomotive. People would like to feel sympathy for gas, and to be grateful for its services since the old times of "Charlies" and swinging oil-lanterns; but it has so domineered over citizens, and screwed such profits out of their necessities, that nobody, except shareholders in gas companies, can experience any lively pity for the threatened interest. Those who cherish any lingering belief in the feeble, blinking lamps which may be seen side by side with the electric light at its best should be reminded that only yesterday, as it were, a Committee of the House of Commons published in a Blue Book that "the subdivision of the electric current was not to be hoped for." Very shortly afterwards Edison and others triumphantly divided it, and so will inventors proceed from one delicate perfection to another until the thing becomes as simple as opening a shutter to let in sunlight and as easy as turning a water-tap. Already it is positively promised that electric lamps, both for buildings and residences, will be cheaper than the lowest selling price of gas. Accidents can be absolutely avoided by proper systems and low tension, and any interruption of supply will be obviated by supplementary storage. Danger by fire will only arise through gross carelessness, and not nearly so much as by the best gas or candles. The lamp will be improved and indefinitely cheapened; indeed, at a lecture presided over by Mr. Spottiswoode, President of the Royal Society, Mr. Lane-Fox pledged his scientific credit to the statement that "a one hundred and fifty candle light would soon be produced by electricity, at the cost of a twelve candle light of gas—namely, a farthing per hour." The change which has been so slowly approaching will now, we expect, come with rapid strides; for all these new companies have fields to fill, and their very rivalry will lead to new developments. There will be disappointments, quarrels, difficulties, contests in Parliament, clashing of new and old claims; but in the end, and no distant end, the exquisite and almost fairy-like gift of modern science must and will prevail, and gas will depart to the limbo of all the old disused resources of mankind, to the benefit of the community in health, wealth, and property, and the considerable economy of our coal supply.

The sagacious public has comprehended all this, and now meets the speculators half way in inaugurating the "Age of Electricity." For let none dream that Ariel will merely lighten our darkness. The delicate and mysterious power, as her methods develope by use, will work everywhere telephones and phonographs, turn our engines, drive tram-cars and locomotives, and perhaps eventually impel our vessels of war and commerce. It is easier to say what can be wrought by this force than what cannot. The public, we repeat, have perceived the arrival of the Electrical Age, and have gone into the City to meet and salute it, after the practical fashion of humanity. The first idea is naturally to make money out of the innovation, and only the shallow-minded will wonder or complain of that. Silly satirists relate with affected horror the story of the railway mania—how Hudson swayed the world of finance, how the stock markets seemed mad, how "stags" and "bears" and "bulls" raged, how at one time people subscribed thousands to make a statue to the Railway King, and afterwards pursued him with invectives. But they forget to add—these cheap and superficial observers of human history—that this wild speculation gave us the railway system of Great Britain years before its time, with blessings and advantages so vast that Hudson deserved a statue quite as well as many a philanthropist who has secured one. They forget to mention that the original lines of that bold and far-seeing projector are precisely those which have thriven most and become the backbone of our iron network, and which will doubtless have by and by a successor in the "Age of Electricity." It is the keen emulation of money-making which floats all these new inventions and sets the genius of the savant at work for the good of mankind. Science would be crippled if it were not for the stock market, where they discount her learned bills, and "bull and bear" her sublime ideas into going concerns. Let not the time therefore be wasted in foolish diatribes against the excitement of the market. What the City calls "enterprise," and moralists "avarice," is as much a necessity of human advancement and civilisation as parental affection is a source of family and civil prosperity. Rash speculators will be punished in the old style, and red-hot projects which have never been properly forged and moulded will come to grief as they deserve. The public at large, however, is wise and right in comprehending that a great new scientific change is approaching, which must be both profitable and progressive; and since the public can take very good care of itself we see no cause for anything but satisfaction that the long stagnation of finance has terminated in this tremendous "electrical current" in the City.

The Nautical Gazette
May. 27. 1882. 2195

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The lighting fixtures of the ship have been furnished by Wm. Porter's Sons, of New York, under the personal supervision of Mr. Joseph Barre, and the work has been indeed well done. There are eleven double electric light chandeliers, two single light chandeliers, ten electric light brackets, five single oil light fixtures in the main saloon. The electric fixtures are of antique design, with rope stem, pendant dolphins, and a richly chased jeweled circular band, with pendants for the electric light, and fitted with very costly porcelain shades, exquisitely decorated. The ladies' boudoir, the captain's, chief engineer's and purser's rooms have the dolphin bracket electric lights, with oil lamps as well. The Social Hall has a 6 light electric chandelier the same as in saloon, with two side light brackets on piano case and bracket lights in the bridal rooms. All the chandeliers and brackets are in rich and costly bronzes.

The *Queen of the Pacific* is lighted throughout by the Edison Electric Light system, which has been put in the vessel under the personal superintendence of Mr. Wilson S. Howell, and she is the most perfectly lighted of any vessel in the world, there being 250 electric lights distributed through the ship, with connections for placing lights on the wharves at her loading and discharging ports on her route. This system uses the incandescent light, which is small, soft and steady, and neither tiresome or hurtful to the eyes. The lamp consists of a pear shaped globe about 4½ inches in height, exhausted of air, into which is sealed a filament of carbonized bamboo, slightly thicker than a horse hair. This filament becoming incandescent by the passage of the current of electricity through it, emits a beautiful, soft, white light, absolutely steady and constant, equaling in intensity, or exceeding if desired the illuminating power of a gas jet of the best quality. These lamps are screwed into a socket in the ceiling of each stateroom, water closet, the butcher's shop, mess room, engine and boiler rooms, shaft alley, all the officers' rooms, crew's quarters, steerage, galley, pantry, passage way, "glory hole," etc.

These lights are so arranged in groups that the steward can turn off the lights in the state rooms, the saloons, in the dome, or in fact, any section of his department at will, or can turn on or off any individual light. In the officers' rooms, or the engine department, each light is manipulated at will or as a whole as desired. There is absolutely no danger from heat, fire or explosion in this system. The "safety catch" precludes the possibility of fire. For lighting steam vessels this light is cheaper, cleanlier and safer than any other means of illumination. The steamer *Columbia* of this line was fitted with the Edison light in 1879 and the success of the system has been very marked. She had 115 lamps in circuit in February last, and they had been run over 415 hours without even one lamp going out, the expense being, for the 115 lamps, with coal at $6 per ton, only 18 cents per hour. The *City of Worcester*, of the N. Y. & Norwich Line, is also fitted with the Edison lights. The *Queen of the Pacific* has two dynamos, run by an 18 horse power (nominal) engine, while the average power to light the vessel is about 10 horse. One of the beauties of this system is that no special engineer or electrician is required to attend the machinery, and it only requires a few minutes' attention daily for oiling, etc. One of the special features of this system of lighting is, there are no smoky lamps, the windows and doors of staterooms and saloons can be kept open, where, with ordinary lamps, they would have to be shut, with a great saving in breakage of chimneys, globes, etc. The steerage in this ship is in forward between-decks under the forecastle deck, and is large, light and well-ventilated, and contains 80 berths in one tier each side, four berths high—while on the forward freight deck are provisions for "standee" berths for deck passengers. In the between decks, in close proximity to the hatches, are located the hoisting engines, which receive their supply of steam from either the donkey or main boilers, as may be required. We counted six of these "hoisters," in fact, the ship is liberally provided with all kinds of labor-saving appliances. No pains or expense have been spared to make her a first-class ship in every respect. Her cost will be not far from a half million dollars, when ready for sea.

2197 The Daily Telegraph. 26th May 1882. 2198

The List will be closed on or before Friday, the 26th May, 1882.

THE SWAN UNITED ELECTRIC LIGHT COMPANY (Limited) (Swan and other patents). Incorporated under the Companies Acts. Capital £1,000,000 Sterling. FIRST ISSUE, £500,000, in 100,000 SHARES of £5 each, of which 19,750 shares (issued as fully paid-up) are taken by the vendors, 13,583 shares have been already subscribed at par, and will be allotted in full, and the balance of 66,667 shares is now offered for subscription, also at par, payable as follows, viz.: 10s. on application, £1 10s. on allotment, and the balance as required, in calls not exceeding £1 each, and at intervals of not less than three months.

DIRECTORS.

JAMES STAATS FORBES, Esq., Chairman (Deputy-Chairman United Telephone Company (Limited).

E. W. Batt, Esq. (Messrs. Elias and Co.), 20, Great Winchester-street, E.C.

*J. C. Stevenson, Esq., M.P., Chairman Swan's Electric Light Company (Limited).

Major-General J. S. Trevor, R.E., C.S.I., late Director-General of Railways in India.

Ernest Villiers, Esq., Director General Steam Navigation Company.

*J. Wilson Swan, Esq., of Newcastle-on-Tyne. } Technical Directors.
*R. E. B. Crompton, Esq., of London and Chelmsford. }

* Will join the board after the allotment.

Bankers—The National Provincial Bank of England (Limited), and its branches.

Solicitors—Messrs. Ashurst, Morris, Crisp, and Co., 6, Old Jewry, E.C.; Messrs. J. and R. S. Watson and Dendy, Newcastle-on-Tyne.

Broker—W. Cuthbert Quilter, 14, King's Arms-yard, E.C.

Secretary (pro tem.)—J. H. Ivory.

Offices—41, Coleman-street, London, E.C.

PROSPECTUS.

This company has been formed for the purpose of acquiring the established business of Swan's Electric Light Company (Limited), with its patent and other rights, for the United Kingdom; also the principal foreign and Colonial patents of Mr. J. Wilson Swan, for, or in connection with, electric lighting.

In addition to the patents for the Swan incandescent lamp, this company has acquired the licence to use (free of royalties) the important patents, for the United Kingdom, of Swan and Sellon for the storage of electricity.

By means of the Swan lamp, the first successful attempt was made to bring the electric light into domestic use in this country. It was so first used in the private residences of Sir William George Armstrong and of Mr. Spottiswoode (the President of the Royal Society) in 1880, and they still continue its use.

The Swan Incandescent Lamp is now so well known that but little description of it is required. It obtained the only gold prize specially awarded to incandescent lamps at the recent Paris Exhibition. It has a prominent position in the existing Electric Light Exhibition at the Crystal Palace, and it is the light adopted at the Savoy Theatre, where there are about 1,200 of the Swan lamps in use every night.

The following is a list of some of the public buildings, mansions, theatres, business premises, and ships to which Swan's patent incandescent lamps have been supplied:

Craigside, the residence of Sir William G. Armstrong.
Combe Bank, the residence of W. Spottiswoode, Esq., President of the Royal Society.
Castle Huntley, the residence of J. M. White, Esq.
The Mansion House.
The British Museum.
The "Times" Office.
The Savoy Theatre.
The Royal Academy.
The North British Railway Station, Glasgow.
The General Post Office, Glasgow.
The "Freeman's Journal" Office, Dublin.
The Hosiery and Drapery Establishments of Messrs. Coxon and Co., Newcastle, and Mr. G. H. Hovey, Sheffield.
The Leather Works of Messrs. Pulman, Godalming.
The Bucton Vale Dye Works of Messrs. Gartside and Co.
The Risca Colliery, near Newport, Mon.
The Sugar Refinery of Messrs. Macfie and Son, Liverpool.
The Flour Mills of Messrs. Hall and Co., and Messrs. Furlong and Co., Cork.
The Dining Rooms of the Manchester Exchange.
The Severn Tunnel Works.
The Channel Tunnel Works.
Steamships belonging to the following companies: Inman, Cunard, White Star, Guion, Orient, British India Steam Navigation, Union Steamship Company of New Zealand, &c.
and to numerous other important establishments at home and abroad.

The Swan Lamp has been accepted for lighting the Royal Courts of Justice.

The evidence of the successful working of the Swan Lamp has been so great and uniform that its excellence as an electric light suited to domestic and general use is now widely recognised.

This company takes over the business of the existing company as a going concern, with all its machinery, tools, stock, &c., so that it will have the great advantage of possessing well-organised and equipped factories, in which about 10,000 lamps per week are now being manufactured.

The business of the existing company is confined to the United Kingdom; but, in order to consolidate and enlarge the scope of the business, this company has acquired from Mr. J. Wilson Swan his patents for, or in connection with, electric lighting for the following countries, viz.: France, Germany, Russia, Austria, Italy, Portugal, Belgium, Sweden, Norway, India, Cape of Good Hope, and Ceylon.

In addition to the patents, this company also becomes possessed of the manufactory and business established by Messrs. J. Wilson Swan and Company, in Paris, where there is already a large and growing demand for the Swan Lamps.

The patent rights for Spain have been sold, and in connection therewith a contract has been entered into for supply of lamps on very favourable conditions, the benefits of which sale and contract pass to this company as from date of its purchase.

There is a large demand from abroad for lamps. In France especially, having regard to the successful result of the competition at the recent exhibition in Paris, the satisfactory installations already made, and the facilities afforded by the manufactory in active operation there, there is the immediate prospect of a large and profitable business.

This company will continue the manufacture of the lamps, &c., at the works already established in this country and in Paris, will establish other manufactories, and, in addition, will grant licences for the use of the company's patents to public bodies, companies, and individuals, both at home and abroad.

The terms for the purchase of the above interests are: (1) For the business, goodwill, property, and net assets of the Swan Company, including the patents for the United Kingdom, £62,000 in cash and £[illegible],750 in fully-paid-up shares; (2) For the foreign and Colonial patents, and the manufactory and business in Paris, £40,000 in cash and £70,000 in fully paid up shares, with option for the company to pay £20,000 of the latter amount in cash in lieu of shares, which option the directors have already determined to exercise. The liabilities of the respective businesses, which are of less amount than the valuation of book debts and stock acquired, are assumed by this company.

The purchase is made on behalf of this company from the vendors direct, without any intermediate profit.

The books of the Swan Company (Limited) have been examined by Messrs. Quilter, Ball, and Co., who have reported as to the book debts, stock in hand, and liabilities.

This company has secured the services of Mr. J. Wilson Swan as technical director for seven years, and in connection therewith the benefit of his future inventions in connection with electric lighting.

Arrangements have been made with the firm of Messrs. R. E. Crompton and Co., under which the company have acquired all their existing lighting contracts (including the Great Northern and South-Eastern Railways at King's-cross and Bricklayers' Arms respectively, the North British Railways, and the Post Office, Glasgow, the city of Norwich, the Belfast Harbour, Mansion House, London, &c.), and certain orders in hand; also the right to the services of Mr. R. E. B. Crompton and his firm as engineers, and the supply on favourable terms of their manufactures, including their arc light, which is sufficiently well known to render it unnecessary to enlarge upon its merits here. By this arrangement the company is enabled to cover the entire field of electric lighting by the arc as well as the incandescent system. Messrs. Crompton's manufactory is one of the largest and most important for electrical machinery and apparatus in this country.

The only agreements entered into are all dated the 15th May, 1882. One made with Mr. J. C. Swan, on behalf of Swan's Electric Light Company (Limited) of the one part and an agent on behalf of this company of the other part; one between Mr. J. Wilson Swan of the one part; and the same agent of the other part and one between Mr. R. E. B. Crompton of the one part and the aforesaid agent of the other part.

These agreements, together with the memorandum and articles of association, can be inspected at the office of the solicitors.

In the event of no allotment being made, the deposit paid on application for shares will be returned in full. Should the shares alloted to any applicant be less than the number applied for, the surplus paid on application will be credited in reduction of the amount payable on allotment.

Prospectuses and forms of application for shares can be obtained at the offices of the company, 41, Coleman street, London, E.C., and from the bankers and broker.

London, 22nd May, 1882.

The Daily Telegraph.

14. June. 1882.

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EDISON'S INDIAN and COLONIAL ELECTRIC COMPANY (Limited).

—Capital £250,000, in 40,000 A shares and 10,000 B shares of £5 each. ISSUE of 35,000 A SHARES, with 6 per cent. cumulative preferential dividend and participation in further profits. 11,000 of these shares have been already applied for, and will be allotted in full. 10s. per share payable on application, 20s. on allotment. Further calls will be made as required, but it is not anticipated that any call will be made during the next six months.

DIRECTORS.

The Most Hon. the Marquis of TWEEDDALE, Chairman.
The Hon. W. St. John Brodrick, M.P., 29, Lower Seymour-street.
Henry Schlesinger, Esq., 5, Kensington Park-gardens (late of the firm of Messrs. Naylor, Benzon, and Co., London, and Messrs. Naylor and Co., U.S.A.)
Colonel the Hon. W. Le Poer Trench, R.E., 3, Hyde Park-gardens.
Sir George Warrender, Bart., of Lochend, N.B.

Consulting Electricians—Mr. Thomas Alva Edison, Mr. Edward H. Johnson.

Bankers—Messrs. Glyn, Mills, Currie, and Co., 67, Lombard-street, London, E.C.; the Commercial Bank of Scotland, Edinburgh.

Solicitors—Messrs. Bircham and Co., 46, Austinfriars, London, E.C.

Brokers—Messrs. Arthur Anderson and Co., 30, Throgmorton-street, London, E.C.

Secretary (pro tem.)—Mr. Cameron Brock.

Temporary Offices—No. 6, Lombard-street, London, E.C.

PROSPECTUS.

This company has been formed for the purpose of acquiring and using in the Empire of India, Ceylon, Australasia, and South Africa the rights and privileges of Mr. Thomas Alva Edison relating to the application of electricity or magnetism as a lighting, heating, or motive agent (except the application thereof for the purpose only of locomotion on railways or tramways or common roads, and except also the right of the Cape Government to use an installation which has been already sent out to them), and for the other objects specified in the memorandum of association, a print of which is in the fold of this prospectus.

A large number of patents or letters of registration have been obtained by Mr. Edison for India and the Colonies of Victoria, New South Wales, Queensland, and New Zealand, all of which are secured to the company. Applications for patents or registrations have been or will be made in the last named colonies, and in South Australia, Tasmania, West Australia, South Africa, and Ceylon, which when obtained will belong to the company, without any further payment except the cost of making or completing such applications.

In addition to the above, the company has acquired a most important advantage in the right to patent and use in Australasia, South Africa, India, and Ceylon, all Mr. Edison's improvements which may be made during the term of five years, from the 12th day of June, 1882. No further payment will accrue to Mr. Edison on the company exercising this right. After the expiration of the term of five years the company will have the option of acquiring all additions and improvements made and patented by Mr. Edison on payment of such sums as may from time to time be agreed on or fixed by arbitration in case of difference. The only reservation in favour of Mr. Edison is in respect of locomotion on railways, tramways, or roads.

The Edison incandescent lamp is unequalled for domestic and general illumination, and is suitable for all places where a steady, brilliant light, absolutely safe in its production and use, is required. It is peculiarly adapted for India and other tropical countries, as it will be unaffected by punkahs and wind currents, and emits comparatively little heat. When once fixed it requires no skilled labour, but can be attended to by an ordinary native or other servant.

The Edison system, however, does not merely comprise a particular form of lamp, dynamo, or regulator, but is a comprehensive whole, embracing every detail essential to the economical, reliable, and safe production and distribution of electricity for the innumerable purposes to which it can be applied, whether in connection with light, heat, or motive power. It includes many ingenious and effective devices believed to be peculiar to this system, some of which are referred to in the following extract from a lecture at the Society of Arts, by Mr. W. H. Preece, F.R.S., Electrician to the Post Office, which affords important independent testimony to the above statements:

"The completeness of Mr. Edison's exhibit was certainly the most noteworthy object in the (Paris) Exhibition. Nothing seems to have been forgotten, no detail missed. There we saw not only the boilers, engine, and dynamo machine, but the pipes to contain the conductors; the conductors themselves, heavy and massive—for Mr. Edison recognises the waste of energy that must occur in small conductors—the insulation, the fixtures, the brackets, the safety catches, the lamps, devices to avoid the effects of expansion and contraction through changes of temperature, meters to measure the current used, regulators to control the consumption of fuel." . . . "Mr. Edison's system has been worked out in detail, with a thoroughness and mastery of the subject that can extract nothing but eulogy from his bitterest opponents. Many unkind things have been said of Mr. Edison and his promises, perhaps no one has been severer in this direction than myself. It is some gratification for me to be able to announce my belief that he has at last solved the problem that he set himself to solve, and to be able to describe to the society the way in which he has solved it."

The safety-catch, above referred to, is an invention for preventing danger from fire in case of the conductors generating heat by reason of breakage or other accidental injury.

The system may be seen in full operation on Holborn Viaduct, where the street extending from Holborn-circus to Old Bailey, the City Temple, two hotels, the entrance to the London, Chatham, and Dover Railway Station, Messrs. Spiers and Pond's restaurant, and numerous shops and offices are lighted up from a central station. The lamps give out very little heat, they may be grasped by the naked hand without danger or inconvenience, are free from odour, and give off no products of a poisonous or noxious character.

This company, deriving as it does its rights and privileges direct from Mr. Edison, will be a parent company. It will be prepared to undertake the business of a lighting and power company, by lighting up towns, public buildings, manufactories, barracks, and residences, and supplying power by means of electricity, and in order to enlist local capital and influence will grant licenses to corporations and local companies to carry on a similar business.

With a view to the early commencement of active operations, the directors have made arrangements for purchasing a number of Mr. Edison's lamps, dynamos, and other materials which are now in London, ready for shipment to some of the principal centres of population and industry within the company's field of operations. Mr. Edison has agreed, until 1st January, 1885, to supply the company with dynamos, lamps, and other specialities of his system, of his own manufacture, at the prices charged by him to his most favoured customers. The company, however, is free to obtain all such things elsewhere, or to manufacture them, whenever it shall be found more advantageous to do so.

The consideration to be paid for the property and rights secured to the company is the sum of £25,000 in cash, 5,000 A shares, fully paid, and ranking as such for dividend, and 10,000 B shares, fully paid, upon which no dividend will be paid until after the A shares have received a cumulative dividend of 6 per cent. per annum. The surplus profits available for dividend, after payment of the 6 per cent. of cumulative dividend on the A shares will be divided equally between A and B shares until the A shares shall have received a dividend equal to 10 per cent. The remaining profits, subject to a percentage payable to the directors, will then be divided equally between the A and B shares respectively. No promotion money will be paid.

The directors are in negotiation for securing the services of an exceptionally competent manager, who will be prepared to visit India and the colonies whenever occasion may require.

The only agreement entered into is dated 12th June, 1882, and made between Thomas Alva Edison, of the first part; George Edward Gouraud, of the second part; and the Marquis of Tweeddale, the Hon. W. St. John Brodrick, M.P., Henry Schlesinger, Colonel the Hon. W. Le Poer Trench, and Sir George Warrender, Bart., of the third part, and which is open to inspection (together with the memorandum and articles of association of the company) at the offices of Messrs. Bircham and Co., Solicitors, 46, Austinfriars, London.

Applications for shares must be made on the accompanying form, to be lodged with Messrs. Glyn, Mills, and Co., of 67, Lombard-street, London, E.C., or the Commercial Bank of Scotland, Edinburgh, the company's bankers, together with a deposit of 10s. per share. In case of no allotment being made, the amount of deposit will be returned in full. Where a smaller number of shares are allotted than are applied for, the balance of the deposit will be applied towards payment of the amount payable on allotment.

Prospectuses and forms of application may be had of the brokers, Messrs. A. Anderson and Co., 30, Throgmorton-street, E.C., and at the temporary offices of the company, 6, Lombard-street, E.C.

The Subscription List will be closed for London on or before Friday, the 16th inst., and for the country on or before Saturday, the 17th inst.

12th June, 1882.

FORM OF APPLICATION FOR SHARES.

To the Directors of Edison's Indian and Colonial Electric Company (Limited).

No.

Gentlemen—Having paid to your bankers the sum of £ being a deposit of 10s. per share, I request you to allot me shares of £5 each in the company, and I agree to accept such shares or any less number that may be allotted to me upon the terms of the prospectus, dated 12th June, 1882, and the memorandum and articles of association of the company, and I authorise you to register me as the holder of the shares allotted to me.

Signature in full.......................................
Address.......................................
Description.......................................
Date June, 1882.

2200

2201

Description of the Edison Steam Dynamo.

By T. A. Edison, Ph. D., and Charles T. Porter.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The central Edison station of the first district in New York City will, when fully equipped, be supplied with twelve dynamos, each of which is nominally rated as a 1200-light machine, at 16 candle-power incandescence, but is capable of supplying 1400 lights of this power, continuously, and with high economy, without heating the armature, or burning or injuring the commutator or brushes. This increased capacity is due to improvements in the lamp itself.

The armature of each dynamo is driven by a Porter-Allen engine, of $11\frac{3}{4}''$ diameter of cylinder by 16″ stroke, directly connected, and making 350 revolutions per minute giving a piston travel of 933 feet per minute.

The steam is supplied by eight Babcock & Wilcox boilers of 2,000 aggregate horse power, and which will work under a pressure of about 120 pounds. These occupy the basement of the building. Over them, the first and second floors being removed, an iron superstructure is erected entirely separated from the walls of the building, and on this the combined dynamos and engines are placed.

One-half of this equipment is now nearly ready for service, and the remainder is expected to be completed during the coming season.

The armature of the dynamo is of the form commonly known as the Siemens armature, but in its construction and "connecting up" it differs radically from all others.

The foundation of the armature, or the iron core which is built upon the shaft, is made up of sheet iron discs, separated from each other by sheets of tissue paper, and bolted together. This has all the advantages of a solid iron core in strengthening the magnetic field, while it completely prevents the great loss of power by local currents, which would circulate in the iron if it were solid. In the place of insulated wires, the cylindrical face of the armature is made up of heavy copper bars, trapezoidal in section, each bar being insulated, and also separated from its

neighbors and from the iron core underneath by an air space.

The connection between the bars on opposite sides of the armature, to form the electrical circuit, is made by copper discs, of the same diameter as the core. At each end of the core are one-half as many of these copper discs as there are bars, each disc being insulated from its neighbors, and the whole being bolted together in such a manner as to form, with the discs of sheet iron constituting the core, one solid mass. Each disc is formed with projecting lugs on its opposite sides to which the two bars are connected.

The connections between the opposite surfaces of an armature are of no benefit in generating an electric current, but are a necessary evil, introducing useless resistance into the circuit. By using for this connection copper discs in the manner described, a great weight of copper is disposed in a limited space; and so this useless resistance, and consequent loss of energy, is reduced to a minimum.

This method, moreover, reduces the work to a simple machine construction, in which all the parts are duplicates, and the operations can be much cheapened and facilitated by the use of special tools.

The spaces between the armature bars admit of a free circulation of air, thereby preventing the accumulation of heat, and increasing to an enormous degree the capacity of the machine. The armature is at intervals wound with piano wire over the bars to resist the centrifugal force developed by their revolution.

The commutator and brushes of an electrical machine are the parts subject to the greatest depreciation. In this machine all parts of the end of the armature are so constructed as to be easy of access, and they can be quickly and cheaply repaired, or removed and replaced by new parts, when necessary. Any accident would require but a short stoppage for repairs.

Provision is made for keeping a continuous and rapid circulation of air over the entire face of the armature.

This armature is 27.8" in diameter by 61" long. The commutator adds 18" to this length, and is itself 12¾" in diameter. The armature shaft is of steel, 7¼" in diameter, having a total length of 10'3". The journals are 6¼" in diameter by 15" long, and run in babbitt-metal bearings in pillow blocks of the box form, giving the greatest stiffness with minimum of weight.

Provision is made for continuous water circulation underneath the boxes, and for continuous lubrication, with traps to prevent the creeping of the oil along the shaft and reaching the commutator, and drains to receive it as it runs through the bearings and convey it to a drip pan.

The magnet is made up of two immense cast iron "pole pieces," between the semi-cylindrical faces of which the armature revolves, twelve cylindrical soft iron cores attached to these pole pieces, and made magnetic by an electrical current circulated in the wire wound around them, and four soft iron keepers connecting the back ends of these cores. Eight of the cores are attached to the upper pole piece, and four to the lower one.

The width of these "poles" is 49", and their height 61½". The length of the twelve soft iron cores is 57", the diameter of the eight upper ones is 8", and of the four lower ones 9".

The four soft iron keepers are each 11" wide by 9" in thickness, and the total length of the magnet is 94".

The magnet is insulated by cast zinc bases 3" in thickness.

The weight of the dynamo is as follows:

Armature and shaft	9,800 lbs.
Two pillow blocks	1,840 lbs.
Magnet, complete	33,000 lbs.
Zinc bases	680 lbs.
Total	44,820 lbs.

The copper is distributed as follows:

In the armature bars	590 lbs.
" " discs	1,350 lbs.
In the magnet wire	1,500 lbs.
Total	3,440 lbs.

Mr. Edison was early impressed with the conviction that to give steady and reliable motion to these armatures it would be necessary to connect an engine to each one of them directly. This combination has been termed by him the Steam Dynamo.

In adapting the Porter-Allen engine to this service a special construction in some respects was found to be called for. These special features will be briefly described.

It seemed important to avoid a rigid connection between the engine and the armature shafts, which would require the entire series of bearings to be maintained absolutely in line. In place of this, therefore, a self-adjusting coupling [see Fig 5, page 3] has been introduced, which will permit of considerable errors of alignment without any abnormal friction being produced in the bearings.*

The point of difficulty was the backlash, the engine having no fly-wheel, except the heavy armature itself, which was to be driven through the coupling. Provision was made for taking this up by steel keys of a somewhat peculiar form, between which the tongues of the coupling move freely, while they themselves are immovable. These keys are held between set-screws threaded in wrought iron rings covering the flanges on the ends of the shaft. All the faces liable to move upon each other are oiled from a central reservoir. This coupling is a very compact affair, without a projection anywhere above its surface, and gives every promise of completely answering its purpose.

The engine is made with a forked bed and two shaft bearings and a double crank, and so is completely self-contained. It is shown in plan and elevation, Figs. 1 and 2.

The shaft having no support beyond these bearings on either side, unusual stiffness was required in the crank pin to prevent deflection under the great strains to which it is subjected.

A novel form of pin (see Fig. 3) was proposed by Mr. Richards, which is found to possess all the rigidity required. It is provided with flanges which are let into each crank, and held each by four screws, as shown, while the shanks of the pin are also forced firmly into the cranks.

Special appliances enabled the work of putting the cranks together in this manner to be done with extreme and uniform accuracy.

The engine is so arranged as to have the valve gear on the side furthest from the dynamo. The engineer has not to go between the engine and the dynamo, when running, for any purpose.

The connecting rod (Fig. 4) is of steel, and the crank-pin boxes are formed directly in the end of it.

This end is finished from a solid forging, and chambered out for babbitt metal. The bolts are then fitted, after which it is parted and holes are drilled for holding the babbitt securely.

In the connecting rods for single crank engines of this type permanent length of rod is secured by forming the crank pin end solid, and taking up the wear by a wedge closing up the inside box. In these double crank engines this construction is impracticable, but the same object is attained by forming the cross head end in the manner shown, in which the strap is made permanent, and the inside box is closed up by a key bearing against a steel plate.

The weight of the reciprocating parts of this engine is as follows:

Piston, with rod	83 lbs.
Cross head	42 "
Connecting rod	109 "
Total	234 lbs.

The initial acceleration of this mass, or the force required, on the dead centers, to give it the motion necessary to relieve the crank from strain is as follows:

$$350^2 \times .66 \times .000341 = 27.57,$$

or 27.57 times the weight of the mass, which gives

$$234 \times 27.57 = 6451 \text{ lbs.}$$

The formula is $R^2 \, l \, c$, when

R=the revolutions per minute;

l=the length of the crank in decimals of a foot; and

c=the coefficient of centrifugal force.

The connecting rod is 48″, or 6 cranks, in length. This affects the initial acceleration, making this to be on the dead center farthest from the crank 7526 lbs., and on the dead center nearest to the crank 5376 lbs., a difference of 40 per cent.

The area of the cylinder is 98.2 square inches.

The area of the piston rod, 1¾ inches diameter, is 2.4 square inches, leaving area of cylinder at crank end 95.8 square inches.

The initial accelerating forces are therefore as follows, viz.: at the end of the cylinder farthest from the crank 77 lbs., and at the end of the cylinder nearest to the crank 56 lbs., on the square inch of piston area.

The counterweight was after some trials fixed at 135 lbs. This leaves 99 lbs. of the reciprocating parts running unbalanced. It is found that this is not sufficient to disturb the stability of the engine, while on the other hand the counterweight is not so great as to exert an objectionable strain in the vertical direction.

The total weight of the engine is 6,445 lbs.

The engine and dynamo are mounted on a cast-iron base plate, made for convenience in two parts, and bolted together.

The dimensions of this base plate are as follows: length 14 feet, width 8 feet 9 inches; and its weight is 10,300 lbs. The entire weight is therefore as follows:

Base plate. - - -	10,300 lbs.
Dynamo, - - -	44,800 "
Engine, - - -	6,450 "
Total - - -	61,550 lbs.

The large engraving is a perspective view of the Dynamo and Engine combined.

The last and most careful test of one of these dynamos gives the following results, as shown by the indicator diagrams, which are here reproduced full size; scale 80 lbs. to the inch.

The lamps used in all the trials were of the older construction, of which 8½ lamps, at 16 candle-power incandescence, require one horse power of electrical energy.

Since these were placed for experimental uses, improvements in the lamp have increased their economy, so that one horse power is sufficient to maintain fully 10 of the present lamps at 16 candle power incandescence.

Diagram No. 1 shows the friction of engine and dynamo at 350 revolutions per minute, requiring .... 13.63 H.P.

Diagram No. 2 shows the resistance with the magnet circuit on = ... 19.17 H.P.

Field 5.78 ohms, 108 volts.

The increased resistance due to the magnets was .... 5.54 H.P.

Of this, the calculated energy developed in the magnets was

$$\frac{103^2 \times 44.3}{5.78 \times 33{,}000} = \ldots\ldots\ldots\ldots\ 2.46 \text{ H.P.}$$

Leaving energy to be accounted for by local currents in iron core of armature, and in armature bars. 3.08 H.P.

Diagram No. 3 shows the work done in maintaining 300 lamps.

These, in the ratio of 8½ to 10, were equal to 353 lamps of the present construction. The pressure was maintained also at 102 volts, representing 25 candle power, in place of 98 volts, representing 16 candle power incandescence, which requires the number of lamps to be increased in the ratio of 102^2 to 98^2, or to 382 lamps.

The pressure of the armature was 104 volts, showing a loss in the conductor of 2 volts, which would increase the number of lamps as 104 : 102.*

The total correction is therefore as follows:

$$300 \times \frac{10}{8.5} \times \frac{102^2}{98^2} \times \frac{104}{102} = 389 \text{ lamps.}$$

The power exerted was .... 60.6 H.P. which gives to the indicated horse power

$$389 + 60.6 = 6.42 \text{ lamps.}$$

The magnet circuit had now a resistance of 5.28 ohms with 104 volts pressure, representing

$$\frac{104^2 \times 44.3}{5.28 \times 33{,}000} = \ldots\ldots\ 2.75 \text{ H.P.}$$

Substituting this in place of 2.46 H.P. in he first trial, we have 19.46 H.P., which, deducted from 60.6 H.P., leaves net 41.14 H.P.

This gives 389+41.14=9.45 lamps per H.P.

Diagram No. 4 shows the work done in maintaining 700 lamps.

The pressure of the lamps was maintained, as in the preceding trial, at 102 volts, which required at the armature a pressure of 105 volts.

The total correction in this case is therefore

$$700 \times \frac{10}{8.5} \times \frac{102^2}{98^2} \times \frac{105}{102} = 919 \text{ lamps.}$$

The power exerted was 115.83 HP. giving to the indicated horse power 919+115.83=7.93 lamps.

The resistance of the magnet circuit was now 4.78 ohms, with 105 volts pressure, representing,

$$\frac{105^2 \times 44\ 3}{4.78 \times 33{,}000} = 3\ 1 \text{ H.P.}$$

Substituting this in place of 2.46 H.P. in the first trial, we have 19.81, which, deducted from 115.83 H.P. leaves net 96.02 H.P.

This gives 919+96.02=9.57 lamps per H.P.

Diagram No. 5 shows the work done in maintaining 1050 lamps.

The pressure at the lamps was maintained in this trial at only 99 volts, but this required at the armature a pressure of 108 volts, showing a loss of 9 volts in conduction.

The total correction in this case is thus

$$1050 \times \frac{10}{8.5} \times \frac{99^2}{98^2} \times \frac{108}{99} = 1375 \text{ lamps.}$$

The power was .... 168.4 H.P.

Giving to the indicated horse power

$$1375 + 168.4 = 8.16 \text{ lamps.}$$

The resistance of the magnet circuit was now 8.28 ohms, with 108 volts pressure, representing

$$\frac{108^2 \times 44\ 3}{8.28 \times 33{,}000} = 4.77 \text{ H.P.}$$

Substituting this in place of 2.45 H.P. in the first trial, we have 21.48 H.P., which, deducted from 168.4 H.P., leaves net 146.92 H.P.

This gives 1375+146.92=9.36 lamps per H.P.

It will be seen that the losses of efficiency due to undiscovered resistances are only

In the first case, 10—9.45=.55 H.P. per lamp,

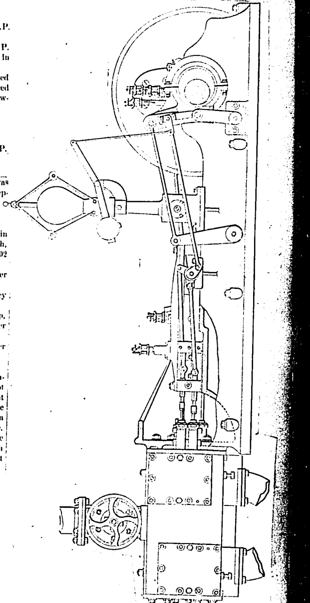
In the second case, 10—9.57=.43 H.P. per lamp, and

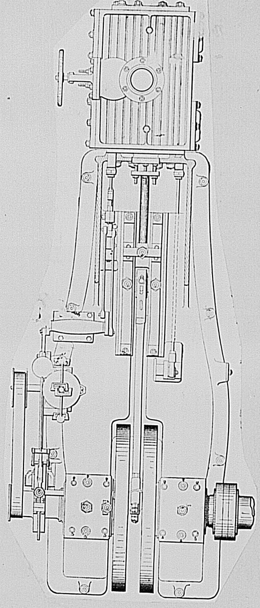
In the third place, 10—9.39=.61 H.P. per lamp,

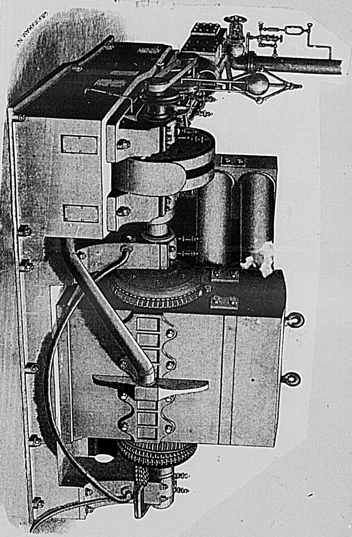
Averaging 5.4 per cent.

The friction in the journals of the armature, when driven in this manner, does not increase with the resistance, and, on account of the action of the reciprocating parts of the engine, that in its bearings is also nearly a constant quantity, whatever the load may be.

The above figures show this very clearly, the subtraction of the friction diagram in each case exhibiting substantially the same net power per lamp.







Steam Dynamo (Dynamo and Engine Combined).

2202

2203

2204

SOCIÉTÉ ÉLECTRIQUE EDISON

Société anonyme au Capital de UN MILLION de Francs

PARIS. — 33, Avenue de l'Opéra. — PARIS

ÉCLAIRAGE

DE

VILLES, RUES, ÉDIFICES PUBLICS ET PARTICULIERS

Châteaux, Magasins.

THÉATRES, USINES, MUSÉES, HOPITAUX, BATEAUX A VAPEUR, CAFÉS, ETC.

CONSEIL D'ADMINISTRATION

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M. ÉLIE LÉON, vice-président.
M. J.-F. BAILEY, administrateur-délégué.
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LE VICOMTE SÉRURIER, »

NOTE SUR L'ÉCLAIRAGE PAR LA LUMIÈRE EDISON

Qualités de la Lumière.

La lumière Edison est déjà employée en Amérique et en Europe dans un grand nombre d'établissements industriels, usines, magasins, banques, journaux, gares de chemins de fer, cafés, salles de spectacle, salles de concert, etc. A New-York, les maisons de tout un vaste quartier sont éclairées jour et nuit par 15,000 lampes à la satisfaction générale; ce n'est que le commencement d'une exploitation régulière qui s'étendra à un périmètre considérable. En Angleterre, en Allemagne, en Russie, en Autriche, en Belgique, en Italie, l'éclairage électrique prend chaque jour une nouvelle extension; il se forme des Compagnies puissantes pour l'exploitation du système Edison.

La nouvelle lumière est en effet destinée à se substituer de plus en plus aux anciens procédés d'éclairage, au gaz, à l'huile, au pétrole, dans les usines, fabriques, manufactures, ateliers, imprimeries, magasins, salles de réunions, etc., dans les châteaux, villas, hôtels, maisons particulières, dans les petites villes, les bourgs, les gros villages, partout, en un mot, où l'on peut disposer, sur place ou à proximité, de la force motrice convenable.

L'avantage sur tous les autres systèmes d'éclairage est évident. La lumière Edison est fixe et ne vacille pas au moindre courant d'air; elle est d'un ton doré agréable et d'un éclat doux qui ne fatigue pas la vue; elle n'élève pas la température de façon à rendre, pendant l'été, certains locaux inhabitables; elle ne vicie pas l'atmosphère, ne dégage ni fumée ni gaz sulfurés détruisant les peintures et les tentures des appartements; elle est indépendante des variations atmosphériques et ne perd pas en pouvoir éclairant avec l'altitude.

Produite en vase clos, brûlant dans l'eau comme dans l'air, au milieu de la ouate, de la paille et des matières les plus inflammables, elle ne laisse pas, comme le gaz, sous la menace perpétuelle de l'incendie, de l'explosion ou de l'asphyxie. On peut affirmer que c'est la lumière qui offre à la fois la sécurité la plus absolue et les conditions hygiéniques les meilleures; elle est sans rivale sous ce double rapport et ne peut être comparée à aucun autre mode d'éclairage.

La lumière Edison présente également des avantages incontestables sur la lumière électrique par arc; elle ne répand pas autour d'elle ces teintes blafardes et violacées propres à l'arc voltaïque; elle ne scintille pas et ne varie pas continuellement dans son éclat; elle ne laisse pas tomber sur les parquets des parcelles de charbons enflammés; elle brûle silencieusement, sans qu'on ait à s'en occuper pendant de longs mois, tandis que chaque jour il faut remettre des baguettes de charbon dans les lampes à arc; elle ne nécessite aucun mécanisme susceptible de dérangement comme ceux des régulateurs à arc. Enfin sa divisibilité poussée à la limite lui permet de remplacer non seulement les plus petits becs de gaz, mais les lampes à huile, les bougies, etc., ce qu'il est absolument impossible d'obtenir avec les régulateurs, puisque le plus petit foyer par arc a encore un pouvoir éclairant d'au moins 30 à 40 becs Carcel.

Il est vrai qu'en apparence au moins l'unité de lumière coûte plus cher dans le système par incandescence, mais comme la lumière peut être beaucoup mieux répartie et distribuée, puisqu'on la divise autant qu'on veut, l'*éclairage*, qu'il ne faut pas confondre avec la *lumière*, revient, en définitive, à un prix moins élevé.

Prix de Revient.

L'éclairage au gaz étant le plus répandu et le plus économique, c'est avec le gaz qu'il est surtout intéressant de comparer la lumière Edison. On va voir que l'éclairage Edison permet de réaliser encore des économies sur l'éclairage au gaz.

Le gaz coûte généralement en France 0 fr. 30 le mètre cube; la consommation *théorique* est de 105 litres par Carcel et par heure; ce qui correspond à une dépense par Carcel et par heure de 0 fr., 0315.

En fait, cette dépense est assez notablement augmentée; elle atteint quatre centimes et quelquefois un peu davantage, soit par suite de l'emploi de becs autres que le type normal à double courant d'air, soit par un défaut de qualité du gaz ou de réglage des robinets et de la pression, soit parce qu'il faut augmenter le débit quand on s'élève à des altitudes de plus en plus grandes.

Le prix de la lumière Edison varie de son côté selon les conditions d'établissement de la force motrice. Dans les usines déjà pourvues de machines à vapeur, où il est facile d'emprunter de la force au moteur, sans installations supplémentaires, le prix est naturellement réduit; il varie dans les limites suivantes:

De 17 lampes à 150 lampes *A* fournissant chacune une lumière équivalente à 1 Carcel, 72, de 2 centimes 34 à 1 centime 74, par lampe et par heure.

De 150 à 500 lampes *A* de 1 centime 74 à 1 centime 50, par lampe et par heure.

Ces prix correspondent par Carcel et par heure à 1 centime 36; 1 centime 01; 0 centime 85.

On n'a pas compris dans ces chiffres l'amortissement du matériel électrique.

Avec l'amortissement, ils s'élèveraient respectivement à 3 centimes 53 ; 2 centimes 46 ; 1 centime 90 par lampe *A* et par heure.

Soit par Carcel et par heure à 2 centimes 05 ; 1 centime 42 ; 1 centime 10.

Ces prix sont inférieurs à ceux du gaz.

Si l'Établissement à éclairer ne possède pas de moteur et qu'il faille nécessairement fournir la force, l'amortissement de ce nouveau matériel grèvera les prix d'une charge supplémentaire. Ces prix pourront monter dans ce cas aux chiffres suivants :

5 centimes 5 pour une installation de 150 lampes *A*.
3 — 62 — — 500 —

Ce qui ne correspond encore respectivement qu'à 3 centimes 19, 2 centimes 10, par Carcel et par heure.

Prix du Matériel Électrique.

Le prix du matériel électrique dans les diverses installations peut se chiffrer approximativement comme il suit :

17 Lampes *A*.	1,940	francs.
60 —	5,650	—
150 —	10,750	—
250 —	15,450	—
500 —	30,900	—

Ces prix ne comprennent pas, bien entendu, l'appareillage variable à l'infini.

Le prix des lampes n'y figure pas non plus, par cette raison que leur usure entre dans l'estimation du coût horaire de la lumière.

On peut toujours remplacer à volonté une lampe *A*, de 1 Carcel 72, par deux lampes *B* de 0 Carcel 86. Mais il en résulte un supplément de dépense d'installation d'environ 12 fr. 50 par nouvelle lampe ajoutée.

Force Motrice.

On peut admettre que dans toutes les installations 1 cheval vapeur transmis à la machine dynamo-électrique actionne 8 lampes *A* de 16 bougies ou 16 lampes *B* de 8 bougies.

Adresser les demandes de renseignements et de devis à la SOCIÉTÉ ÉLECTRIQUE EDISON, 33, Avenue de l'Opéra, Paris.

000. — PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7.

RAPPORT

DU

Conseil d'administration

AUX ACTIONNAIRES DE LA COMPAGNIE EDISON

DE NEW-YORK

Pour les Installations Isolées

FAIT A LEUR PREMIÈRE RÉUNION ANNUELLE

du 21 novembre 1882.

Lorsque cette Compagnie a été formée, il y a un an, les affaires concernant les installations isolées n'avaient pris aucun développement, aucune base ne pouvait être prise pouvant donner une indication pour l'avenir. A ce moment, M. Edison ne fabriquait qu'un seul type de machines Dynamo isolée, le Dynamo Z ; nous n'avions aucune machine à vapeur sur laquelle nous pouvions absolument compter, et les innombrables détails se rapportant aux installations, tels que appareillage, coupe-circuits et autre matériel, étaient encore imparfaits et n'étaient pas fabriqués sur une grande échelle.

A ce moment, il n'y avait que huit installations isolées de faites ou en cours d'exécution, une ou deux seulement fonctionnaient. Nous n'avions pas formé de personnel spécial, à part quelques employés appartenant au bureau de New-York de la Compagnie, et nous n'étions que peu préparés au développement de l'affaire.

Au début, le plan adopté par notre Compagnie était de ne faire qu'un petit appel de capital et de ne développer l'affaire sur une base prudente et économique que lorsque la période d'expérimentation serait passée. Nous avons suivi rigoureusement ce plan.

Cependant l'accroissance de l'affaire a été si continue que, actuellement, tout le capital est engagé d'une façon profitable et offrant la plus grande sécurité.

Les affaires de la Compagnie dans l'année écoulée jusqu'au 19 novembre courant ont été aux Etats-Unis de 137 installations isolées d'une importance variant de 15 à 800 lampes chacune. Ces installations ont été faites dans des filatures, usines, hôtels, bateaux à vapeur, bureaux de journaux, magasins de nouveautés, etc., etc.

Le nombre total des lampes employées dans ces installations est de 25.426.

Les offices de journaux éclairés par les installations Edison sont : le New-York Hérald, le Philadelphia Ledger, le Philadelphia Record, le Ohio State Journal, le Boston Hérald, le Baltimore Sun, le Davenport Gazette ainsi que l'imprimerie et les bureaux de MM. Weed, Parsons et Cie Albany.

Pour toutes les parties du travail que comporte l'impression des journaux, la lumière Edison a été reconnue comme constituant un précieux moyen d'éclairage artificiel à cause de sa fixité et parce qu'elle ne dégage aucune chaleur.

Une liste des installations faites par la Compagnie ou qui sont en cours d'exécution accompagne ce rapport, la lecture de cette liste montrera que nous éclairons les principales filatures du pays.

Notre lumière semble donner satisfaction générale à tous nos clients, car nous avons reçu d'eux un nombre considérable de témoignages qui proclament les mérites de la lumière Edison.

La meilleure preuve de cette satisfaction se trouve dans le fait qu'aucune installation faite à l'essai n'a été abandonnée, mais qu'au contraire la plupart ont été agrandies.

Nous citerons :

1° MM. Seymour, Sabin et Cie Stillwater Minnesota, dont l'installation, à l'origine, qui était composée de 2 dynamo Z. avec 250 lampes B., est maintenant d'un dynamo K. de 250 lampes A.

2° Danforth Locomotive Works, Paterson, N.J. Installation d'un dynamo Z. de 60 lampes A. à l'origine, et actuellement d'un dynamo L. de 150 lampes A.

3° La Pemberton Compagnie, Lawrence. Mass. Installation d'un dynamo Z. de 125 lampes B. portée maintenant à 2 dynamos L. de 300 lampes.

4° La Merrimac Manufacturing Company, Lowel. Mass. Installation de 2 dynamos Z. de 250 lampes B. à l'origine, portée à un dynamo K. de 250 lampes A.

5° La Merrack Thread Company, Holyoke, Mass. Installation d'un dynamo Z. de 120 lampes B., portée à un dynamo K. de 400 lampes B.

6° Les Wamsutta Mills, New-Bedford, Mass. Installation d'un dynamo Z. de 60 lampes A., portée à 3 dynamos K. de 750 lampes A.

7° MM. Weed, Parsons et Cie, Albany, New-York. Installation d'un dynamo Z. de 120 lampes B., portée à 1 dynamo K. de 250 lampes B.

8° M. Max Ams, New-York City. Installation d'un dynamo E. de 15
lampes A., portée à un dynamo Z. de 60 lampes A.
9° MM. Sayles et Washburn, Mechamsville. Conn. Installation d'un dy-
namo Z. de 120 lampes B., portée à 1 dynamo L. de 300 lampes B.
10° MM. George, Urban et Cie, Buffalo. New-York. Installation d'un
dynamo E. de 15 lampes A., portée à un dynamo Z. de 60 lampes A
11° MM. H. K. et F. B. Thurber et Cie. New-York City. Installation
d'un dynamo Z. de 60 lampes A. à l'origine, portée à deux dynamos Z. de
90 lampes A. et 80 lampes B. et d'un dynamo K. de 250 lampes A.
Nous devons dire que toutes nos installations ont été faites à prix fixe
sans exception dans aucun cas. Notre prix courant a toujours été invariable-
ment maintenu.
Il peut se faire que dans quelques cas des commandes aient été perdues
par suite de cette règle, mais nous croyons en somme que nos affaires ont
profité de l'application rigide de ce principe.
Une branche nouvelle et importante pour l'avenir des affaires de la Com-
pagnie demande une mention spéciale. Il s'agit de l'éclairage des villages et
des villes, trop petites pour être éclairées à l'aide de stations centrales.
Une expérience de ce genre est en train de se faire actuellement à Roselle,
N. J. Les frais sont partagés entre notre Compagnie et la « Edison Electric
Light Cie. »
L'éclairage de ce village doit commencer au mois de décembre de cette
année ; s'il réussit, comme nous le croyons, l'éclairage des villages formera
peut-être la branche la plus importante pour l'avenir de notre Compagnie.
Quand nous considérons les progrès accomplis depuis l'année dernière
dans les stations isolées, nous avons lieu de croire que l'année prochaine verra
se produire, non seulement une grande augmentation dans ces sortes d'affaires,
mais encore que l'éclairage des villages, si l'installation de Roselle réussit,
se développera avec une rapidité et une sûreté égales.
La question d'une augmentation de capital demande une attention im-
médiate, car le matériel actuel de la Compagnie suffit à peine pour les
affaires présentes. Il est complètement insuffisant pour les augmentations
immédiates que nous avons tout lieu d'attendre.
Voici quelles sont nos conditions actuelles de vente d'installations :
Traite payable à 30 jours après que l'installation est terminée. Cela
équivaut à donner 30 jours à l'acheteur pour l'essai de la lumière.
Il est probable que plus tard ces conditions pourront être moins larges,
mais pour le moment nous ne devons pas les élargir. Comme d'autre part
nous sommes obligés de payer comptant presque tout notre matériel, mo-
teurs et Dynamos compris, il est évident que si nos affaires augmentent,
nous ne pourrions pourvoir à cette augmentation sans augmenter le capital.
L'examen de la situation financière de la Compagnie ainsi qu'il est dé-

montré par le rapport ci-joint du secrétaire démontre que les finances de la Compagnie sont dans un état satisfaisant.

Il est évident que nous avons à peine un capital suffisant pour le courant actuel de nos affaires, qu'il est complètement insuffisant pour nous permettre de remplir les commandes qui sont entre nos mains.

ACTIF

Dynamos, moteurs, etc., etc.	305.071 45
Agence, comptes non soldés, travail en cours.	74.799 60
Soldes des comptes.	47.376 65
Installations en cours.	309 979 05
Matériaux en main prix coûtant.	230.238 90
Comptes des acheteurs.	550.799 10
Effets à recevoir.	6.469 90
Encaisse métallique.	11.289 20
Francs.	1.536.023 85

PASSIF

Capital versé.	1.124.250 »
Comptes non soldés.	121 035 15
Profits et Pertes.	290.738 70
Francs.	1.536.023 85

C'est avec plaisir que nous félicitons la Compagnie sur sa condition prospère actuelle et sur ses espérances futures. En établissant l'affaire nous n'avons pas eu seulement à surmonter les obstacles habituels que rencontre toute nouvelle entreprise, mais également nous avons dû tout créer dans cette affaire sans précédents. Il en a été de même pour les nombreux détails mécaniques de l'affaire pour lesquels les faits tirés de l'expérience n'ont pu être utilisés.

Nous pouvons donc dire que nous avons été les premiers dans l'introduction pratique de l'éclairage électrique par incandescence et que l'œuvre entreprise par notre Société d'établir avec succès des installations de lumière électrique par incandescence est le premier exemple donné en ce genre.

Nous croyons qu'il y a lieu de se féliciter d'avoir pu réussir sur une large échelle dans le court espace d'une année et d'avoir pu en même temps distribuer un dividende rémunérateur pour la première année de notre existence.

1511. — PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7.

SOCIÉTÉ ÉLECTRIQUE
Edison
PARIS

N° II

COMPAGNIE CONTINENTALE
Edison
PARIS

Nous reproduisons ci-dessous une dépêche reçue par le Consul Général des États-Unis à Berlin en réponse à la demande qu'il avait adressée à l'Inspecteur Général du Comité des Compagnies d'Assurances de New-York contre l'incendie, au sujet des bruits qui avaient trouvé place dans quelques journaux de Berlin affirmant que la Station Centrale Edison, à New-York, ne fonctionnait pas régulièrement :

TÉLÉGRAMME

A Monsieur S. G. Brewer, Consul Général des États-Unis à Berlin.

New-York, le 24 novembre 1882.

« En réponse à vos questions par câble, je viens vous répondre que la Compagnie Edison de cette ville a actuellement installé 2709 lampes qui sont alimentées par sa Station Centrale. Je les ai toutes examinées et acceptées, et le Comité des Compagnies d'Assurances de New-York a donné des certificats pour ces lampes. Elles sont installées dans 191 immeubles. Le nombre des dynamos marchant pendant la journée est de deux : trois dynamos fonctionnent de 4 à 7 heures du soir. Dans les immeubles ci-dessus mentionnés il y a des fils posés pour 4288 lampes : d'ici au 1er décembre j'aurai complété l'inspection de 1,000 lampes de plus, qui rendront nécessaire l'emploi de 4 dynamos. La Station Centrale ne s'est pas arrêtée un seul instant jour et nuit depuis qu'elle a commencé à fonctionner le 4 septembre. »

« *Signé* : R. S. OSBORN »

« *Inspecteur du Comité de New-York des Compagnies d'Assurances.* »

Comme complément à cette dépêche nous ajoutons les renseignements suivants qui nous sont parvenus officiellement de la Compagnie Edison de New-York.

« Tous les abonnés de la Station Centrale de M. Edison à New-York ont été questionnés par la Compagnie sur leur opinion au sujet de la lumière Edison. Tous ont répondu, sans exception, que, non seulement ils en étaient très contents, mais même qu'ils ne pourraient plus s'en passer. »

« Certains intérêts, hostiles à l'éclairage électrique, ayant fait circuler le bruit que l'isolation des conducteurs n'était pas parfaite et qu'il y avait des pertes de courants, M. Edison a fait savoir, par l'entremise des journaux de New-York, que ce bruit était absolument faux, invitant qui que ce soit à faire contrôler par des électriciens le fonctionnement de la Station centrale.

En ce moment les Ingénieurs de la Société Edison, à New-York, sont occupés à établir le bilan de la Station Centrale afin de voir quels sont les bénéfices réalisés par cette Station. M. Edison a invité toute Société ayant un intérêt dans l'affaire à envoyer un Ingénieur pour vérifier ce bilan.

Nous sommes autorisés à dire, d'après ce bilan, que la lumière électrique, système Edison, peut désormais être fournie au même prix et aux mêmes conditions que le gaz avec bénéfices pour les actionnaires de la Société. »

En effet la Société Edison pour les installations isolées, à New-York, qui a été constituée il y a un an à peine, après avoir donné 51 pour cent de ses bénéfices comme prix de licence à la Société mère, a gagné 15 pour cent, sur son capital qui est de 2.500.000 fr.

1538. — PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7.

The Edison Electric Light Company

OF EUROPE LIMITED

65, Fifth avenue New-York, October 6th. 1882.

Messieurs PUSKAS et BAILEY

(A Paris, France.)

A une réunion du Conseil d'administration qui a eu lieu le 20 Octobre 1882 les trois résolutions suivantes ont été adoptées :

1re Résolution. — Que l'article 4 du contrat du 15 Novembre 1881 soit modifié dans le sens que la Compagnie continentale n'exigera pas moins de 25 0/0 (au lieu de 45 0/0) du premier capital mentionné dans ledit article à condition que ce Capital ne soit pas moindre de 2,000,000 de francs pour chaque 100,000 habitants; et 15 0/0 de toute augmentation dudit Capital, d'exiger de plus une redevance d'au moins 50 centimes sur chaque lampe employée dans les stations centrales. Dans le cas où le Capital original serait inférieur à 2,000,000 de francs pour chaque 100,000 habitants, la Compagnie continentale ne pourra exiger moins de 25 0/0 du Capital et 25 0/0 au lieu de 15 0/0 de toute augmentation dudit Capital jusqu'à ce que l'augmentation atteigne le Capital de 2,000,000 de francs pour chaque 100,000 habitants. Après avoir atteint ce chiffre le pour cent des augmentations subséquentes sera de 15 0/0 ainsi qu'il est fixé plus haut.

De plus il est résolu que S. B. Eaton, le deuxième Vice-Président de la Compagnie ou toute autre personne appartenant à l'Administration est

autorisé par ces présentes, à exécuter, au nom de la Compagnie et d'apposer le sceau de la Compagnie sur tous documents ou écritures qui lui sembleraient nécessaires pour remplir les formalités de cette résolution.

2me Résolution. — Vu que dans l'article 13 du contrat du 15 Novembre 1881 il est prévu qu'en cas de formation de Sociétés de fabrication en France ou à l'étranger, sous les conditions dudit article 13, la proportion de bénéfices réservée par ledit article sera payée à notre Compagnie :

Et vu que l'intention de notre Compagnie est de ne pas réclamer toute ladite proportion des bénéfices, mais de permettre à la Compagnie Continentale de participer dans la même proportion que celle où elle participe déjà dans d'autres affaires :

Il est résolu que : lorsque des sociétés de fabrication seront organisées conformément audit article 13 la proportion des bénéfices y réservée à notre Compagnie sera réglée à la Compagnie Continentale de la même manière que les recettes provenant d'autres sources; la distribution sera faite à cette Compagnie, en nature ou autrement, ainsi qu'il est stipulé à l'égard d'autres recettes.

De plus il est résolu que S. B. Eaton, le deuxième Vice-Président de la Compagnie ou toute autre personne appartenant à l'Administration est autorisé par ces présentes à exécuter, au nom de la Compagnie, et d'apposer le sceau de la Compagnie sur tous documents ou écritures qui lui sembleraient nécessaires pour remplir les formalités de cette résolution

3me Resolution. — Que la Compagnie Continentale soit, et qu'elle est par ces présentes invitée à consentir à l'insertion d'une clause dans le contrat du 15 novembre 1881 et à la modification de ce contrat à l'effet de, quand la Compagnie Continentale aura reçu des bénéfices provenant de titres ou d'autres manières par la vente de droits ou par des licences de patente ou autrement, le tant pour cent de tous ces bénéfices revenant à notre Compagnie lui soit payé en nature à moins qu'elle ne choisisse, par écrit, d'accepter tout autre mode de liquidation qui pourrait être proposé suivant l'occasion par les administrateurs de la Compagnie Continentale.

De plus il est résolu que S B. Eaton, le deuxième Vice-Président de la Compagnie, ou toute autre personne appartenant à l'Administration, est autorisé par ces présentes à rédiger la minute d'une clause pour être incorporée, de consentement avec la Compagnie Continentale, dans ledit contrat du 15 novembre 1881, comme amendement, et comprenant la provision sus-mentionnée dans cette résolution.

Conformément à ces résolutions, j'ai rédigé les trois amendements suivants au contrat du 15 novembre 1881, que je vous prie de soumettre à la Compagnie Continentale, si les administrateurs les approuvent, et de rédiger en forme légale afin qu'ils soient exécutés par la Compagnie Continentale et par notre compagnie

Les modifications proposées des contrats sont les suivantes : 1° quant à la modification proposée dans l'article 4, le dernier paragraphe commençant par les mots *il est entendu*, et se terminant par les mots *Compagnie locale* doit être supprimé et remplacé par le paragraphe suivant :

Il est entendu qu'au cas de cessions à une Société locale du droit d'exploitation d'une ville entière ou d'un district par la transmission du courant électrique, d'une station centrale, le prix des brevets à percevoir par la Société d'exploitation d'une telle Société locale ne devra pas être moindre de 25 0/0 du capital actions, original de la dite Société et pas moindre de 15 0/0 de toute augmentation dudit capital actions, pourvu que le capital original ne soit pas moindre de 2,000,000 de francs pour chaque 100,000 habitants (ou dans cette proportion) dans le territoire indiqué.

Dans le cas ou ledit capital original serait inférieur à 2,000,000 de francs pour chaque 100,000 habitants (ou dans cette proportion) dans un territoire, le prix des brevets sera de 25 0/0 comme il est stipulé plus haut, du capital original ; mais dans le cas d'une ou de plusieurs augmentations subséquentes. la Société d'exploitation aura à exiger 25 0/0 d'une telle augmentation jusqu'à ce que le capital soit égal à la base de capitalisation, c'est-à-dire dans la proportion de 2,600,000 de francs pour chaque 100,000 habitants, mais après avoir atteint ce chiffre, le tant pour cent devra être alors de 15 0/0 ainsi qu'il est stipulé plus haut.

2° A l'égard de la modification proposée à l'article 13, le texte suivant est proposé à l'acceptation : supprimer la dernière moitié de l'article 13 qui commence par les mots « A la Light Company » et qui finit par les mots « autorise la création », et en remplacement de ce qui est supprimé, insérer ce qui suit : « A être payé à la Compagnie Continentale pour être employé par elle de la même façon que les produits provenant de l'organisation de sociétés locales pour l'exploitation des stations centrales, la distribution en étant faite à la Light Company en nature ou autrement à son choix. »

3° Quant aux amendements proposés au contrat exigeant paiement en nature à faire à la Light Company il est proposé que les termes de cette demande soient annexés à la fin de l'article 3. Dans ce cas le paragraphe additionnel de la fin de l'article 3 devrait être ainsi conçu : « Lorsque la Compagnie Continentale recevra des revenus ou des bénéfices, soit en actions, soit en argent, provenant de la vente de droits ou de cessions de licences pour l'emploi de brevets ou autrement, le pour cent de ces produits revenant à la Light Company conformément à ce contrat devra être payé en nature à moins que, par écrit, elle n'en dispose autrement. »

Veuillez comprendre que je n'insiste pas sur le mot à mot exact des amendements proposés; vous remarquerez pour ce qui concerne le texte des trois résolutions qu'une grande latitude est laissée quant à la rédaction de ces trois amendements, la seule restriction étant qu'ils doivent être conformes à l'esprit des résolutions.

En conséquonce vous n'hésiterez pas à les modifier dans la forme qui paraitra la meilleuro au Conseil d'administration do la Compagnio Continentale toujours en tenant compte de l'esprit des résolutions et en n'en affectant pas le sens et à faire tout changement qui vous serait suggéré soit par votre propre jugement, soit par la Compagnie Continentale.

Après que la Compagnie Continentale aura exécuté ces amendements, si vous voulez me les transmettre je ferai en sorte qu'ils soient exécutés et retournés promptement.

Ils devront naturellement être exécutés en double de manière que nous ayons une copie et que la Compagnie Continentale en ait une autre.

Tout à vous,

S. B. EATON,

Second Vice-President.

[illegible] — PARIS. — IMPRIMERIE CHARLES BLOT, RUE BLEUE, 7.

SOCIÉTÉ ÉLECTRIQUE EDISON
SOCIÉTÉ ANONYME
Capital un million de francs
PARIS

N° IV

COMPAGNIE CONTINENTALE EDISON
SOCIÉTÉ ANONYME
Capital un million de francs
PARIS

Parfois, des personnes étrangères aux questions concernant l'éclairage électrique nous ont fait quelques remarques sur le prix de nos installations, croyant, au premier abord, ce prix plus élevé que celui d'autres installations établies à l'aide de systèmes similaires. En entrant à ce sujet dans quelques considérations on se rendra facilement compte que, si quelquefois il existe une différence dans le coût d'une installation, cette différence est largement compensée, non seulement par les appareils accessoires qui assurent un bon et pratique fonctionnement de l'éclairage, mais aussi par la qualité de notre matériel qui, au point de vue tant mécanique qu'électrique, a été étudié de façon à être employé industriellement. C'est-à-dire qu'il peut fonctionner entre toutes les mains sans demander ni grands soins ni hommes spéciaux. En effet, plusieurs de nos installations sont conduites par des jeunes gens de 14 à 16 ans, comme par exemple celle du Conseil Municipal de Paris qui fonctionne déjà depuis huit mois et qui est confiée aux soins d'un jeune garçon d'environ quinze ans.

Beaucoup de systèmes, tout en exigeant une grande surveillance, sont sujets à de fréquents accidents ou à des interruptions dans l'éclairage.

C'est pourquoi le choix d'un matériel électrique exige autant d'attention que s'il s'agissait de l'achat d'une force motrice ou d'une machine à vapeur.

En effet l'installation la moins chère sera celle qui, une fois posée, demandera le moins d'entretien, de réparations, et fonctionnera le plus économiquement tandis que l'économie qu'on aurait pu réaliser sur les dépenses premières en employant une machine médiocre disparaîtra rapidement. Il en est de même dans les applications d'éclairage électrique.

Notre système d'éclairage par incandescence dans le vide, créé par M. Edison, vu ses grands avantages pratiques et la faveur avec laquelle il est accueilli et apprécié, a trouvé des imitateurs et des contrefacteurs qui prétendent offrir des systèmes similaires à des prix plus avantageux.

Pour prouver que ces assertions ne sont pas fondées, nous nous bornerons à citer les conclusions de la Commission, qui, lors de l'Exposition d'Électricité, a été chargée par M. le Ministre des Postes et Télégraphes de faire un rapport officiel sur la valeur de chaque système.

Cette Commission, présidée par M. le professeur H. TRESCA, et composée de :

MM. GEORGE F. BARKER.
WILLIAM CROOKES.
ED. HAGENBACH.
A. KUNDT.
E. MASCART.

a conclu, après une série d'expériences minutieuses, que la lampe Edison étant celle qui, à intensité égale, exigeait le moins de force était, par conséquent, la plus économique.

Outre cette importante déclaration nous pouvons ajouter que la durée de nos lampes est de beaucoup supérieure à la durée des lampes de nos imitateurs, et, qu'enfin, nos machines génératrices d'électricité ont été étudiées et construites en vue de ce système spécial d'éclairage. Les relations entre la production et la consommation d'électricité sont établies d'une façon très précise et de manière à ce que la dépense d'électricité et le travail nécessaire pour la produire soient proportionnels au nombre de foyers allumés; conditions essentielles pour qu'une installation fonctionne économiquement.

Cette seule considération suffirait pour déterminer le choix que l'on doit faire lorsqu'il s'agit d'adopter un système d'éclairage; il en existe beaucoup d'autres dont l'énumération nous obligerait à entrer dans des détails techniques que nous serons très heureux de fournir lorsqu'ils nous seront demandés, mais que nous croyons devoir laisser de côté dans ce simple aperçu.

Avant de terminer nous devons faire remarquer que le courant produit par nos générateurs d'électricité est incapable d'occasionner le moindre accident; un enfant peut impunément toucher nos conducteurs.

En dehors d'un bon rendement, M. Edison a introduit dans son système la sécurité la plus absolue et n'a voulu laisser aucune place à la critique. Pour atteindre ce but il a créé non seulement une lampe, mais encore tout un système complet d'éclairage.

Que peut-on espérer d'un éclairage fait à l'aide d'une lampe de M. X..., des appareils de M. Z, et d'une machine productrice d'électricité qui parfois sera une machine à courants alternatifs, système aujourd'hui complètement condamné?

Dans un semblable éclairage comment s'établiront les relations entre la dépense d'électricité et la consommation?

Quel sera le résultat de cette combinaison bâtarde? Production coûteuse et mauvais fonctionnement! Où est le gain?

1537. — PARIS. — IMPRIMERIE CHAIX, RUE BLEUE, 7.

THE EDISON LIGHT AT HOLBORN.

London Electrician — [illegible] 1882.

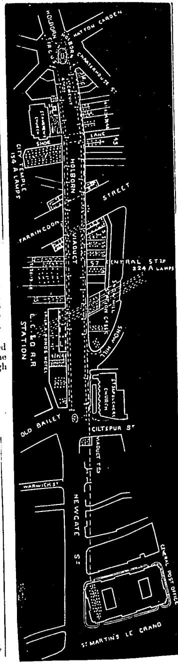
2205

In our last issue we mentioned the commencement of the public working of the Edison incandescent lamps at Holborn. It will be remembered that Mr. Edison has devoted his energies almost entirely to the construction of a complete system of incandescent lighting. He believes the work of the arc lamp, with its enormous candle-power, to be extremely limited when compared with the opening for lighting by incandescence. We have seen and appreciated the brilliant lighting by means of the arc lamps. We are now able to contrast street lighting by their aid with that obtained from the Edison lamps. The lighting of streets, however, is of secondary importance—the great question is, Can we light our houses with this pure light with some approach to economy? We do not think the future of the electric light depends on the ability to distribute it under the current prices of gas. It is nonsense to suppose that a householder now paying £50 a year for gas will make much fuss about an extra five pounds if it should be found necessary (which, however, we deny will be the case). He will prefer the electric light for a number of reasons which we need not enter into here.

Mr. Swan has previously used the incandescent lamp for street lighting at Newcastle-on-Tyne, but to the energy of Mr. Edison we owe the first installation upon a scale large enough to once for all show what can be expected from such lights. The generating apparatus at Holborn has already been described by us, as has Edison's lamp and connections, so that at present we shall confine ourselves to giving the plan of the scene of operation, with a few details as to circuits. We ought, however, to say that the second Edison dynamo has been erected at Holborn, and either of the machines is sufficiently powerful to supply the current required by the lamps. Most of the lamps used are those called A lamps, having a candle-power of about 16 candles, but some few B lamps of half this intensity are used. The resistance of the A lamps (hot) is about 125 ohms, the B lamps having about half this resistance. The E.M.F. of the current required for the A lamps is 110 volts, and this is the E.M.F. of Mr. Edison's dynamo, the current through each lamp being about ·8 amperes. About 10 of the A lamps and 20 of the B lamps are obtained per horse-power. As the A lamps are all arranged in single multiple arc, the reader can always obtain an approximate idea of the resistance of the circuit by dividing the resistance of one lamp by the number of lamps.

$$\text{Resistance of circuit} = \frac{\text{resistance of lamps}}{\text{number of lamps in circuit}}.$$

The arrangements at Holborn have been carried out by Mr. E. H. Johnson, manager for Mr. Edison in this country, and Mr. J. Hammer, engineer. The plan of the streets, &c., lighted, given hereunder, will enable readers to trace the circuits. We shall be better able to judge of the value of these lights when the whole arrangements are complete, it being intended, we believe, to place a lamp of greater candle-power in the streets. The following tables show how the various lights are distributed:—



Plan of the Edison Electric Light Installation at Holborn Viaduct.

		A.	B.	Total
Streets, Bridges, Stair Towers, &c.	1st circuit	66	—	
	2nd „	40	—	
	3rd „	27	—	
	4th „	31	—	
				164
Buildings				
1st Circuit.	No. 38, Negretti, Zambra	11	—	
	38, Sharp and Co	25	—	
	41, Vaseline Company	6	—	
	42, Hodge and Essex	8	—	
	43, 44, Holland and Co.	8	—	
	45, Steel and Garland	9	—	
	53, W. D. and H. O. Wills.	10	—	
	55, Terry and Co.	5	4	
	56, J. Buck	12	—	
				78
2nd Circuit	58, H. S. Ward and Co.	11	—	
	61, Smith and Son	8	—	
	62, Dreydell and Co.	3	—	
	63, Boyle and Co	9	—	
	64, 65, Jenks and Wood	12	—	
	60, City Rubber Stamp Co.	6	—	
				49
3rd Circuit	3, Monington & Western.	16	—	
	Imperial Hotel	13	14	
	London, Chatham, and Dover Railway	9	—	
	Spiers & Pond's Restaurant	20	—	
	Spiers & Pond's Hotel	18	—	
	15, Coventry Machines Company	7	—	
	18, 20, Perry and Co.	21	—	
	21, Pall Mall Electric Association	9	—	
	22, Meriden Britannia Company	5	—	
	Holborn Land Co.	4	—	
	Levy and Nephew	3	—	
				162
4th Circuit	City Temple	147	14	
	Lusher and Son	7	4	
				172
Central Station 57		216	16	232
Viaduct Tavern		9	22	31
General Post Office		50	—	50
	Grand Total			938

2206

Einladung 2211

für

Herrn Chas Batschelor

zu dem am

Samstag den 4. November 1882

nach der

Eröffnungs-Vorstellung im Stadt-Theater

stattfindenden

FEST-MAHLE

im

Redouten-Saale.

Diese Karte berechtigt nur die bezeichnete Person zur Theilnahme am Festmahle.

(Man erscheint im Salonanzug mit weißer Cravate).

2212 2213

week, and he looked forward to the time when, as on the Atlantic, there should be one a day. As the company were returning to town in a special train, attached to one bringing up passengers who had just landed from the Potosi, an accident, happily not of a serious character, happened on the railway. Four or five carriages in the middle of the train left the metals at some points between the Tidal Basin and Canning Town. Two or three first-class carriages were somewhat damaged, but no passengers were injured.

ON METERS FOR POWER AND ELECTRICITY.*

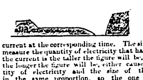
By Mr. C. VERNON BOYS.

THE subject of this evening's discourse—"Meters for Power and Electricity"—is unfortunately, from a lecturer's point of view, one of extreme difficulty, for it is impossible to fully describe any single instrument of the class without diving into technical and mathematical niceties which this audience might well consider more scientific than entertaining. If then, in my endeavour to explain these instruments and the purposes which they are intended to fulfil, in language as simple and as untechnical as possible, I am not as successful as you have a right to expect, I must ask you to lay some of the blame on my subject and not all on myself.

I shall at once explain what I mean by the term "meter," and I shall take the flow of water in a trough as an illustration of my meaning. If we hang in a trough a weighted board, then, when the water flows past it, the board will be pushed back; when the current of water is strong, the board will be pushed back a long way; when the current is less it will not be pushed so far; when the water runs the other way the board will be pushed the other way. So by observing the position of the board, we can tell how strong the current of water is at any time. Now, suppose we wish to know, not how strong the current of water is at this time or at that, but how much water altogether has passed through the trough during any time, as, for instance, one hour. Then, if we have no better instrument than the weighted board, it will be necessary to observe its position continuously to keep an exact record of the corresponding rates at which the water is passing every minute, or better every second, and to add up all the values obtained. This would, of course, be a very troublesome process. There is another kind of instrument which may be used to measure the flow of the water—a paddle-wheel or screw. When the water is flowing rapidly the wheel will turn rapidly; when slowly, the wheel will turn slowly; and when the water flows the other way, the wheel will turn the other way, so that if we observe how fast the wheel is turning we can tell how fast the water is flowing. If, now, we wish to know how much water altogether has passed through the trough, the number of turns of the wheel, which may be shown by a counter, will at once tell us. There are, therefore, in the case of water, two kinds of instruments, one which measures at a time, and the other during a time. The term meter should be confined to instruments of the second class only. As with water so with electricity, there are two kinds of measuring instruments, one of which, the galvanometer, may be taken as a type, which shows by the position of a magnet how strong a current of electricity is at a time, and the other which shows how much electricity has passed during any time. Of the first, which are well understood, I shall say nothing; the second, the new electric meters and the corresponding meters for power, are what I have to speak of to-night. It is hardly necessary for me to mention the object of making electric meters. Every one who has had to pay his gas bill once a quarter probably quite appreciates what the electric meters are going to do, and why they are at the present time attracting so much attention. So soon as you have electricity laid on in your houses, as gas and water are laid on now, so soon will a meter of some sort be necessary, in order that the companies which supply the electricity may be able to make out their quarterly bills, and refer complaining customers to the faithful indications of their extravagance in the mysterious cupboard in which the motor is placed. The urgent necessity for a good meter has called such a host of inventors into the field, that a complete account of their labours is more than any one could hope to give in an hour. Since I am one of this host, I hardly like to pick out those inventions which I consider of value. I cannot describe all, I cannot act as a judge and say these only are worthy of your attention, and I do not think I should be acting fairly if I were to describe my own instruments only and ignore those of everyone else. The only way I see out of the difficulty is to speak more particularly about my own work in this direction, and to speak generally on the work of others.

I must now ask you to give your attention for a few minutes to a little abstract geometry. We may represent any changing quantity, as, for instance, the strength of an electrical current, by a crooked line. For this purpose we must draw a straight line to represent time, and make the distance of each point of the crooked line above the straight line a measure of the strength of the current at the corresponding time.

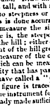
FIG 1



The size of the figure will then measure the quantity of electricity that has passed, for the stronger the current is the taller the figure will be, and the longer it lasts the longer the figure will be, either cause makes both the quantity of electricity and the size of the figure greater, and in the same proportion, so the one is a measure of the other. Now it is not an easy thing to measure the size of a figure, the distance round it tells nothing; there is, however, a geometrical method by which its size may be found. Draw another line, with a great steepness where the figure is tall, and with a less steepness where the height is less, and with no steepness or horizontal where the figure has no height. If this is done accurately, the height to which the new line reaches will measure the size of the figure first drawn: for the taller the figure is, the steeper the hill will be: the longer the figure, the longer the hill; either cause makes both the size of the figure and the height of the hill greater, and in the same proportion; so the one is a measure of the other, and so, moreover, is the height of the hill, which can be measured by scale, a measure of the quantity of electricity that has passed.

The first instrument that I made, which I have called a "cart" integrator, is a machine which, if the lower figure is traced out, will describe the upper. I will trace a circle, the instrument follows the curious bracket shaped line that I have already made sufficiently black to be seen at a distance, the height of the new line measures the size of the circle; the instrument has squared the circle. This machine is a thing of mainly theoretical interest; my only object in showing it is to explain the means by which I have developed a practical and automatic instrument, of which I shall speak presently. The guiding principle in the cart integrator is a little three-wheeled cart, whose front wheel is controlled by the machine. This, of course, is invisible at a distance, and therefore I have here a large front wheel alone. On moving this along the table, any twisting of its direction instantly causes it to deviate from its straight path. Now suppose I do not let it deviate, but compel it to go straight, then at once a great strain is put upon the table which is urged the other way. If the table can

FIG.2



move it will instantly do so. A table on rollers is inconvenient as an instrument, let us therefore roll it round into a roller, then on moving the wheel along it the roller will turn, and the amount by which it turns will correspond to the height of the second figure drawn by the cart integrator. If, therefore, the wheel is inclined by a magnet under the influence of an electric current, or by any other cause, the whole amount of which we wish to know, then the number of turns of the roller will tell us this amount: or to go back to our water analogy, if we had the weighted board to show current strength, and had not the paddle-wheel to show total quantity, we might use the board to incline a disc in contact with a roller, and then drag the roller steadily along by clockwork. The number of turns of the roller would give the quantity of water. Instruments that will thus add up continuously indications at a time, and so find amounts during a time, are called integrators. The most important application that I have made at present of the integrator described is what I have called an engine-power meter. The instrument is on the table, but as it is far too small to be seen at a distance, I have arranged a large model to illustrate its action. The object of this machine is to measure how much work an engine has done during any time, and show the result on a dial, so that a workman may read it off at once, without having to make any calculations.

FIG 3

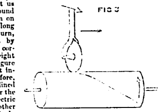
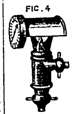


FIG. 4



Before I can explain how work is measured, perhaps I had better say a few words about the meaning of the word "work." Work is done when pressure overcomes resistance, producing motion. Neither motion nor pressure alone is work. The two factors, pressure and motion, must occur together. The work done is found by multiplying the pressure by the distance moved. In an engine, steam pushes the piston first one way then the other, overcomes resistance, and does work. To find this we must multiply the pressure by the motion at every instant, and add all the products together. This is what the engine-power meter does, and it shows the continuously growing result on a dial. When the piston moves it drags the cylinder along; where the steam presses the wheel is inclined. Neither action alone causes the cylinder to turn, but when they occur together the cylinder turns, and the number of turns registered on a dial shows with mathematical accuracy how much work has been done.

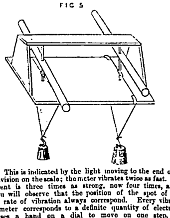
In the steam engine work is done in an alternating manner, and it so happens that this alternating action exactly suits the integrator. Suppose, however, that the action, whatever it may be, which we wish to estimate is of a continuous kind, such, for instance, as the continuous passage of an electric current. Then, if by means of any device we can suitably incline the wheel, so long as we keep pushing the cylinder along, so long will its rotation measure and indicate the result; but there must come a time when the end of the cylinder is reached. If then we drag it back again, instead of going on adding up, it will begin to take off from the result, and the hands on the dial will go backwards, which is clearly wrong. So long as the current continues, so long must the hands on the dial turn in one direction. This effect is obtained in the instrument now on the table, the electric energy meter, in this way. Clockwork causes the cylinder to travel backwards and forwards by means of what is called a mangle motion, but instead of moving always in contact with one wheel, the cylinder goes forward in contact with one and back in contact with another on its opposite side. In this instrument the inclination of the wheels is effected by an arrangement of coils of wire, the main current passing through two fixed concentric solenoids, and a shunt current through a great length of fine wire on a movable solenoid, hanging in the space between the others. The movable portion has an equal number of turns in opposite directions, and is therefore unaffected by magnets held near it. The effect of this arrangement is that the energy of the current—that is, the quantity multiplied by the force driving it, or the electrical equivalent of mechanical power—is measured by the slope of the wheels, and the amount of work done by the current during any time, by the number of turns of the cylinder, which is registered on a dial. Professors Ayrton and Perry have devised an instrument which is intended to show the same thing. They make use of a clock, and cause it to go too fast or too slow by the action of the main on the shunt current; the amount of wrongness of the clock, and not the time shown, is said to measure the work done by the current. This method of measuring the electricity by the work it has done is one which has been proposed to enable the electrical companies to make out their bills.

The other method is to measure the amount of electricity that has passed without regard to the work done. There are three lines on which inventors have worked for this purpose. The first, which has been used in every laboratory ever since electricity has been understood, is the chemical method. When electricity passes through a salt solution it carries metal with it, and deposits it on the plate by which the electricity leaves the liquid. The amount of metal deposited is a measure of the quantity of electricity. Mr. Sprague and Mr. Edison have adopted this method; but as it is impossible to allow the whole of a strong current to pass through a liquid, the current is divided; a small proportion only is allowed to pass through. Provided that the proportion does not vary, and that the metal never has any motions on its own account, the increase in the weight of one of the metal plates measures the quantity of electricity.

The next method depends on the use of some sort of integrating machine, and this being the most obvious method, has been attempted by a large number of inventors. Any machine of this kind is sure to go, and is sure to indicate something, which will be more nearly a measure of the electricity as the skill of the inventor is greater.

Meters for electricity of the third class are dynamical in their action, and I believe that what I have called the vibrating meter was the first of its class. It is well known that a current passing round iron makes it magnetic. The force which such a magnet exerts is greater when the current is greater, but it is not simply proportional. If the current is twice or three times as strong, the force is four times or nine times as great, or generally, the force is proportional to the square of the current. Again, when a body vibrates under the influence of a controlling force, as a pendulum under the influence of gravity, four times as much force is necessary to make it vibrate twice as fast, and nine times to make it vibrate three times as fast; or generally, the square of the number measures the force. I will illustrate this by a model. Here are two sticks nicely balanced on points, and drawn into a middle position by pieces of tape to which weights may be hung. They are identical in every respect. I will now hang a 1 lb. weight to each tape, and let the pieces of wood swing. They keep time together absolutely. I will now put 2 lb. on one tape. It is clear that the corresponding stick is going faster, but certainly not twice as fast. I will now hang on 4 lb. One stick is going at exactly twice the pace of the other. To make one go three times as fast it is obviously useless to put on 3 lb., for it takes four to make it go twice as fast. I will hang on 9 lb. One now goes exactly three times as fast as the other. I will now put 4 lb. on the first, and leave the 9 lb. on the second; the first goes twice while the second goes three times. If instead of a weight we use electro-magnetic force to control the vibrations of a body, then twice the current produces four times the force, four times the force produces twice the rate; three times the current produces nine times the force, nine times the force produces three times the rate, and so on; or the rate is directly proportional to the current strength. There is on the table a working meter made on this principle. I allow the current that passes through to pass also through a galvanometer of special construction, so that you can tell by the position of a spot of light on a scale the strength of the current. At the present time there is no current; the light is on the zero of the scale; the meter is at rest. I now allow a current to pass from a battery of the new Faure-Sellon-Volckmar cells which the Storage Company have kindly lent me for this occasion. The light moves through one division on the scale, and the meter has started. I will ask you to observe its rate of vibration. I will now double the

FIG 5



current. This is indicated by the light moving to the end of the second division on the scale; the meter vibrates twice as fast. Now the current is three times as strong, now four times, and so on. You will observe that the position of the spot of light and the rate of vibration always correspond. Every vibration of the meter corresponds to a definite quantity of electricity, and causes a hand on a dial to move on one step. By looking at the dial, we can see how many vibrations there have been, and therefore how much electricity has passed. Just as the vibrating sticks in the model in time come to rest, so the vibrating part of the meter would in time do the same, if it were not kept going by an impulse automatically given to it when required. Also, just as the vibrating sticks can be timed to one another by sliding weights along them, so the vibrating electric meters can be regulated to one another so that all shall indicate the same value for the same current, by changing the position or weight of the bobs attached to the vibrating arm. The other meter of this class, Dr. Hopkinson's, depends on the fact that centrifugal force is proportional to the square of the angular velocity. He therefore allows a little motor to drive a shaft faster and faster, until centrifugal force overcomes electro-magnetic attraction, when the action of the motor ceases. The number of turns of the motor is a measure of the quantity of electricity that has passed.

I will now pass on to the measurement of power transmitted by belting. The transmission of power by a strap is familiar to every one in a treadle sewing machine or an ordinary lathe. The driving force depends on the difference in the tightness of the two sides of the belt, and the power transmitted is equal to this difference multiplied by the speed; a power meter must, therefore, solve this problem—it must subtract the tightness of one side from the tightness of the other side, multiply the difference by the speed at every instant, and add all the products together, continuously representing the growing amount on a dial. I shall now show for the first time an instrument that I have devised, that will do all this in the simplest possible manner. I have here two wheels connected by a driving band of india-rubber, round which I have tied every few inches a piece of white silk ribbon. I shall turn one a little way, and hold the other. The driving force is indicated by a difference of stretching, the pieces of silk are much further apart on the tight side than they are on the loose. I shall

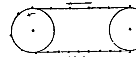


FIG. 6.

now turn the handle, and cause the wheels to revolve; the motion of the band is visible to all. The india-rubber is travelling faster on the tight side than on the loose side, nearly twice as fast; this must be so, for as there is less material on the tight side than on the loose, there would be a gradual accumulation of the india-rubber round the driven pulley, if they travelled at the same speed; since there is no accumulation, the tight side must travel the fastest. Now it may be shown mathematically that the difference in the speeds is proportional both to the actual speed and to the driving strain; it is, therefore, a measure of the power or work being transmitted, and the difference in the distance travelled is a measure of the work done. I have here a working machine which shows directly on a dial the amount of work done; this I will show in action directly. Instead of india-rubber, elastic steel is used. Since the driving pulley has the velocity of the tight side, and the driven of the loose side of the belt, the difference in the number of their turns, if they are of equal size, will measure the work. This difference I measure by differential gearing which actuates a hand on a dial. I may turn the handle as fast I please; the index does not move, for no work is being done. I may hold the wheel, and produce a great driving strain; again the index remains at rest, for no work is being done. I now turn the handle quickly, and lightly touch the driven wheel with my finger. The resistance, small though it is, has to be overcome; a minute amount of work is being done, the index creeps round gently. I will now put more pressure on my finger, more work is being done, the index is moving faster; whether I increase the speed or the resistance the index turns faster; its rate of motion measures the power, and the distance it has moved, or the number of turns, measures the work done. That this is so I will show by an experiment. I will wind up in front of a scale a 7 lb. weight; the hand has turned one-third round. I will now wind a 28 lb. weight up the same height; the hand has turned four-thirds of a turn. There are other points of a practical nature with regard to this invention which I cannot now describe.

There is one other class of instruments which I have developed of which time will let me say very little. The object of this class of instruments is to divide the speed with which two registrations are being effected, and continuously record the quotient. In the instrument on the table two iron cones are caused to rotate in time with the registrations; a magnetised steel reel hangs on below. This reel turns about, and runs up or down the cones until it finds a place at which it can roll at ease. Its position at once indicates the ratio of the speeds which will be efficiency, horse-power per hour, or one thing in terms of another. Just as the integrators are derived from the steering of an ordinary bicycle, so this instrument is derived from the double steering of the "Otto" bicycle. Though I am afraid that I have not succeeded in the short time at my disposal in making clear all the points on which I have touched, yet I hope that I have done something to remove the very prevalent opinion that meters for power and electricity do not exist.

* Royal Institution of Great Britain.

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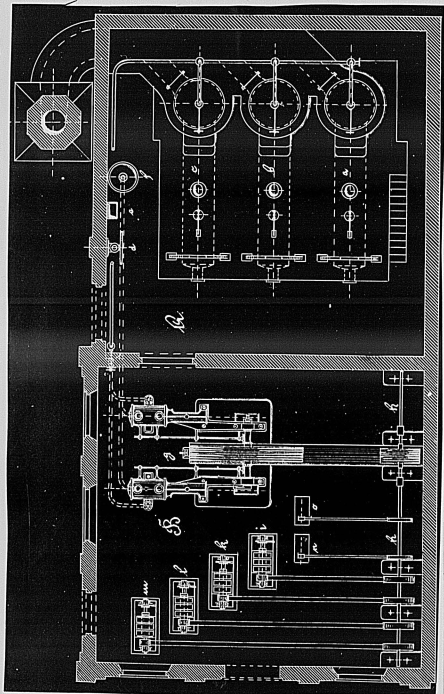
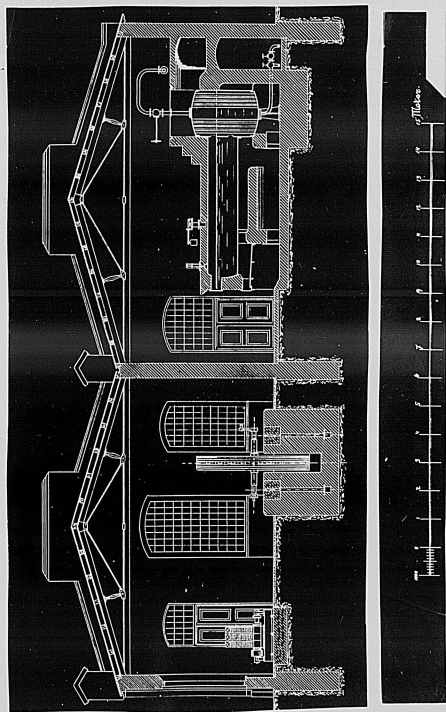




2221

NEW YORK HERALD, SUNDAY, OCTOBER 8, 1882.

"LET THERE BE LIGHT!"

EDISON'S ANSWER TO AN ANONYMOUS COMMUNICATION TO A GASLIGHT PERIODICAL—INCANDESCENT LIGHTING IN THE DOWNTOWN DISTRICT OF NEW YORK—THE EDISON COMPANY'S PROGRESS.

"That's not so. That's printed only to amuse the stockholders of these gas companies," was Mr. Edison's reply after he had read a newspaper clipping wherein an anonymous writer had been suffered to say:—"Mr. Edison has just met with the greatest disappointment of his life—the complete failure of his attempt to light 2,500 houses with his incandescent lamps by his underground system of wires. But fifty houses could be lighted, the electricity being conveyed away owing to imperfect insulation. As the insulation was supposed to be perfect the conclusion is that underground conductors cannot be made to work."

Mr. Edison laughed heartily as he glanced over the newspaper extract again and repeated, "That's printed only to amuse the stockholders of these gas companies. Go down stairs and tell Eaton to show you the official reports of his subordinates."

Major Eaton, vice-president of the Edison Electric Light Company, was found writing a bulletin for the stockholders of that company, in refutation of the excerpt above quoted. "Right glad to see a HERALD reporter," he said, extending his hand and drawing up a chair. "You see," the Major began, "a gaslight periodical published a letter from a correspondent under a printed notice that the paper was not responsible for what the correspondent said. The correspondent, who doesn't sign his name, says he saw in Washington an electrical inventor, whose name he doesn't give, who says that he was told by an electrician whose name is not given, but who had 'just returned from New York, whither he had been summoned for consultation,' that Edison's underground system was an utter failure. Now," the Major continued, his lips contracting and his pupils dilating, "nothing could be falser. No electrician was ever summoned, none ever came, and the underground system, which has been in daily use since we started on the 4th of September last, and all of which, fourteen miles in length, has been underground on an average over nine months, is a complete success, even more so than we expected. Our underground conductors are made in lengths of twenty feet. We test every length, and reject every length that does not show a resistance of 150,000,000 ohms. If our entire network of about 80,000 feet in length were put to the same test that we put each length to, the maximum theoretical efficiency or perfection of the entire network would show a total leakage of current of 141 foot pounds per minute, or, in other words, .00 427 of one horse power. Our actual tests and use of this fourteen miles of network falls only a trifle short of the theoretical perfection, and demonstrates the fact that the whole network, when in operation with 14,500 lamps in circuit, will show a loss of only 238 foot pounds or .007 of a single lamp, which is only forty-eight millionths of one per cent of the entire current used—a loss practically insignificant."

THE PROGRESS OF ELECTRIC LIGHTING.

"What have you done down to this time, Major? When do you intend to light the uptown districts?" the reporter interrupted.

"One minute," the Major replied, reaching for a ream or two of statistics. "The evils of leakage are greatly exaggerated. The most ordinary insulation is good enough, provided the materials are such as are not affected by moisture and air. The actual practical results in our downtown district show that if we had the entire city lighted with (say) 400,000 lamps the loss from leakage would be inappreciable, probably not a loss of current enough to lose a single lamp. We have not struck a single weak point electrically. We have had the usual trouble with running new engines, but these have all been overcome by keeping the machines in motion. We have just finished running one engine eighty-four hours, and have thus run it into working order. Our down-town district, bounded by Nassau street and the East River and Wall street, Spruce street and Ferry street to Peck slip, is in all respects ready to supply customers as fast as they come. Thus far we are supplying eighty-two houses in this district. We are building motors to be used by customers who want power in this district.

"In the uptown district, bounded by Twenty-fourth and Thirty-fourth streets, and Madison and Eighth avenues, we have only made a survey preparatory to introducing the light. We have visited every house and ascertained the number of gas burners, the amount of the gas bills, and the probable demand for power to run sewing machines, elevators and pumps. We found in this district 41,000 gas jets actually burning in winter, 220 pumps used to raise water to cisterns in private houses, 2,281 sewing machines and 48 steam engines, with a total horse power of 1,443. The gas bills aggregate $41,000 per month.

"We have sent machinists to Milan, Italy, to start a station like the one we have down town in New York, and the light has become so exclusively used in Europe that an independent company has been founded in Paris. The rapid increase of our business in the New England States has compelled us to form a separate department there, with headquarters in Boston. We are supplying light for almost all the Northern cities between Boston and San Francisco, and for some cities in the South. Our new lamp factory, in East Newark, N. J., will have an ultimate capacity of 40,000 lamps a day."

LARGE STRUCTURES WIRED.

Major Eaton noted the introduction of the light into South America and elsewhere, and then spoke of several large buildings that had been wired, notably the Mills Building, at Wall street and Exchange place, in which there are 75,000 feet of wire conductors. He continued:—"We have just received an order to light the new steamboat Pilgrim with 802 lamps. This will be the biggest plant we have out. The HERALD office is next. And, by the way, I have just received the report of Superintendent Vail as to the HERALD plant."

The Major passed it over to the reporter. It is as follows:—

The boiler, engine and dynamos are located in the basement of the Bennett Building, corner of Ann and Nassau streets. The boiler has a nominal capacity of 125 horse power. The engine is capable of easily developing 125 horse power, and is now running at an average speed of 250 revolutions per minute. The dynamos have an electric motive force of 110 volts and a capacity of 250 "A" lamps each. We have sufficient engine and boiler capacity to add two additional "K" dynamos. The dynamos are connected in multiple arc to the conducting lines, and either one can be instantly thrown out of use.

The current is conducted from the dynamos to the HERALD Building through 400 feet of electric tubing, 330 feet of which is laid underground through Ann street. There is also about 170 feet of electric tube in use in the HERALD Building, comprising a horizontal and vertical main.

We have wired the building, and placed fixtures for 692 lamps, which are located as follows:—

BENNETT BUILDING.—Engine and boiler rooms, 9.

HERALD BUILDING.—Sub-basement—Press room, 98. Basement—Folding room, 41; stereotype room, 40; machine shop, 10. First story—*Telegram* office, 7; HERALD counting room, 51. Second story—Library room, 92; office and private rooms, 17. Third story—Editorial rooms and office, 47. Fourth story—*Telegram* composing and editorial rooms and HERALD city editor's rooms, 80. Fifth story—HERALD composing room, 103. Sundry halls, closets, &c., 18; reflector for lighting large news bulletin outside, 13. Total "A" lamps, 692.

The plant was started on Monday, September 4, 1882, and has been in use every night since. The average number of lamps in use every night, except Saturday, is 385; on Saturday night 400. The greatest number of lamps are in use from twelve o'clock midnight until two A. M., when the HERALD is being made up and going to press.

"Can there be any danger in using the Edison light, Major?" the reporter inquired.

"Absolutely no danger," the Major replied. "Our current is only 110 volts. That of the arc light, which killed a man the other day, is 2,190."

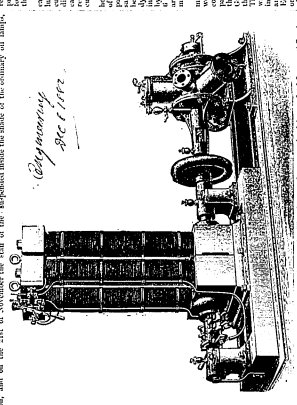
"About the price?"

"It is believed that we can supply our light at $1 per 1,000 candles. This is about the price of ordinary gas. We rely upon the electric light to introduce itself when on a par with gas as to price."

2222

THE ELECTRIC LIGHT ON THE S.S. "TARAWERA."

THE Edison Electric Light Company, Limited, received a contract recently for lighting two ships belonging to the Union Steamship Company of New Zealand, the Tarawera and the Waihora. The Tarawera was built by Messrs. Denny Brothers, at their yards at Dumbarton, and on the 21st of November the staff of the



Engineering
Dec 8 1882

Edison Company commenced wiring the vessel. The dynamo and engine were placed in a small room, 12 ft. by 11 ft. and 7 ft. high, opening into the engine room, the floor being on a level with the gallery running round the top of the cylinders of the main engines. The wiring of the vessel is done in the most careful manner, nothing but the most highly insulated wire, protected by an india-rubber covering, and over that a waterproof covering of waxed thread, being used. The wires were all laid under the woodwork of the vessel in wood beading, made for the purpose, and at proper places safety catches with fusible lead wires were placed to obviate any danger of over-heating. The fixtures to carry the lamps are nickel-plated and of an elaborate character; in the saloon, arrangements have been made by which the incandescence lamps are suspended inside the shade of the ordinary oil lamps, but can be removed at pleasure at a moment's notice; the state rooms are lit by a single lamp, controlled by a switch placed within hand reach of the occupant of the berth; the lamps, which are enclosed in opalescent glass shades, are all the ordinary Edison 16-candle type, requiring an electromotive force of 96 volts to make each yield its normal light. In the gangways and the ladies' drawing-room the lamps are suspended from the ceiling enclosed in opalescent glass globes. The lamp in each state room is controlled by its own tap on the socket; the lamps in the saloon are all controlled by a single switch placed in the engine-room, so that the light can be shut out at eleven o'clock, leaving the lamps burning in the state rooms.

The generator is one of the Edison 150-light dynamos, which has been slightly modified in order to reduce the normal speed; it is capable of being driven practically and conveniently without belting. The following data supply the necessary information as to the dynamo.

Resistance of armature, 0.1 ohm; resistance of each leg of field magnets, 20 ohms; speed, 475 revolutions per minute, electromotive force, 96 volts; current, 120 ampères; length of armature, 5 ft. 5¼ in.; diameter of armature, 10 in.; 150 lamps of 16 measured candle power are maintained, each lamp having a resistance of 125 ohms hot, and taking 0.8 ampères of current.

The dynamo was driven by one of Mr. Peter Brotherhood's well known three-cylinder engines, 7 in. diameter of cylinders, 4½ in. stroke, working up to 20 horse power. Both generator and engine are fixed on the same base-plate, which is bolted down to a teak bedding 3 in. thick, through the deck beams, the dynamo being further stayed by cross-stays holding it in position. The extreme size of the bed-plate is 9 ft. by 3 ft., the height of the machine over all being 6 ft. 6 in. The illustration which we annex shows the arrangement clearly. The engine takes steam from the main boilers.

The preliminary trials having been made of the machinery, to show that everything was in perfect working order, on the 2nd of December a numerous company were invited by the Union Steamship Company of New Zealand to witness the trial runs on board the vessel which was lying in the Albert Harbour, Greenock. At two o'clock the engine was started, and the lights all over the vessel illuminated simultaneously. The engine ran with extreme smoothness, and there was an entire absence of any flickering or unsteadiness in the light. Saloons were illuminated with a uniform and steady light, and in the state rooms the single Edison lamps gave about eight or ten times the light ordinarily afforded to the occupants. A special feature of this generator is its high economy in the conversion of mechanical power into electrical energy, and the very moderate speed at which it runs. This speed of about 475 revolutions a minute, is one at which the Brotherhood engines have run with the greatest ease for long periods of time without adjustment or repairs. The gentlemen present on Saturday, comprising as they did, in addition to representatives of

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NEW YORK HERALD, SUNDAY, OCTOBER 8, 1882.

LET THERE BE LIGHT!

EDISON'S ANSWER TO AN ANONYMOUS COMMUNICATION TO A GASLIGHT PERIODICAL—INCANDESCENT LIGHTING IN THE DOWNTOWN DISTRICT OF NEW YORK—THE EDISON COMPANY'S PROGRESS.

"That's not so. That's printed only to amuse the stockholders of those gas companies," was Mr. Edison's reply after he had read a newspaper clipping wherein an anonymous writer had been suffered to say:—"Mr. Edison has just met with the greatest disappointment of his life—the complete failure of his attempt to light 2,500 houses with his incandescent lamps by his underground system of wires. But fifty houses could be lighted, the electricity being conveyed away owing to imperfect insulation. As the insulation was supposed to be perfect the conclusion is that underground conductors cannot be made to work."

Mr. Edison laughed heartily as he glanced over the newspaper extract again and repeated, "That's printed only to amuse the stockholders of these gas companies. Go down stairs and tell Eaton to show you the official reports of his subordinates."

Major Eaton, vice-president of the Edison Electric Light Company, was found writing a bulletin for the stockholders of that company, in refutation of the excerpt above quoted. "Right glad to see a HERALD reporter," he said, extending his hand and drawing up a chair. "You see," the Major began, "a gaslight periodical published a letter from a correspondent under a printed notice that the paper was not responsible for what the correspondent said. The correspondent, who doesn't sign his name, says he saw in Washington an electrical inventor, whose name he doesn't give, who says that he was told by an electrician whose name is not given, but who had 'just returned from New York, whither he had been summoned for consultation,' that Edison's underground system was an utter failure. Now," the Major continued, his lips contracting and his pupils dilating, "nothing could be falser. No electrician was ever summoned, none ever came, and the underground system, which has been in daily use since we started on the 4th of September last, and all of which, fourteen miles in length, has been underground on an average over nine months, is a complete success, even more so than we expected. Our underground conductors are made in lengths of twenty feet. We test every length, and reject every length that does not show a resistance of 100,000,000 ohms. If our entire network of about 80,000 feet in length were put to the same test that we put each length to, the maximum theoretical efficiency or perfection of the entire network would show a total leakage of current of 111 foot pounds per minute, or, in other words, .00 127 of one horse power. Our actual tests and use of this fourteen miles of network falls only a trifle short of the theoretical perfection, and demonstrates the fact that the whole network, when in operation with 14,500 lamps in circuit, will show a loss of only 258 foot pounds or .007 of a single lamp, which is only forty-eight millionths of one per cent of the entire current used—a loss practically insignificant."

THE PROGRESS OF ELECTRIC LIGHTING.

"What have you done down to this time, Major? When do you intend to light the uptown districts?" the reporter interrupted.

"One minute," the Major replied, reaching for a ream or two of statistics. "The evils of leakage are greatly exaggerated. The most ordinary insulation is good enough, provided the materials are such as are not affected by moisture and air. The actual practical results in our downtown district show that if we had the entire city lighted with (say) 400,000 lamps the loss from leakage would be inappreciable, probably not a loss of current enough to lose a single lamp. We have not struck a single weak point electrically. We have had the usual trouble with running new engines, but these have all been overcome by keeping the machines in motion. We have just finished running one engine eighty-four hours, and have thus run it into working order. Our down-town district, bounded by Nassau street and the East River and Wall street, Spruce street and Ferry street to Peck slip, is in all respects ready to supply customers as fast as they come. Thus far we are supplying eighty-two houses in this district. We are building motors to be used by customers who want power in this district.

"In the uptown district, bounded by Twenty-fourth and Thirty-fourth streets, and Madison and Eighth avenues, we have only made a survey preparatory to introducing the light. We have visited every house and ascertained the number of gas burners, the amount of the gas bills, and the probable demand for power to run sewing machines, elevators and pumps. We found in this district 41,000 gas jets actually burning in winter, 220 pumps used to raise water to cisterns in private houses, 2,281 sewing machines and 48 steam engines, with a total horse power of 1,443. The gas bills aggregate $41,000 per month.

"We have sent machinists to Milan, Italy, to start a station like the one we have down town in New York, and the light has become so exclusively used in Europe that an independent company has been founded in Paris. The rapid increase of our business in the New England States has compelled us to form a separate department there, with headquarters in Boston. We are supplying light for almost all the Northern cities between Boston and San Francisco, and for some cities in the South. Our new lamp factory, in East Newark, N. J., will have an ultimate capacity of 40,000 lamps a day."

LARGE STRUCTURES WIRED.

Major Eaton noted the introduction of the light into South America and elsewhere, and then spoke of several large buildings that had been wired, notably the Mills Building, at Wall street and Exchange place, in which there are 75,000 feet of wire conductors. He continued:—"We have just received an order to light the new steamboat Pilgrim with 802 lamps. This will be the biggest plant we have out. The HERALD office is next. And, by the way, I have just received the report of Superintendent Vail as to the HERALD plant."

The Major passed it over to the reporter. It is as follows:—

The boiler, engine and dynamos are located in the basement of the Bennett Building, corner of Ann and Nassau streets. The boiler has a nominal capacity of 125 horse power. The engine is capable of easily developing 125 horse power, and is now running at an average speed of 250 revolutions per minute. The dynamos have an electric motive force of 110 volts and a capacity of 250 "A" lamps each. We have sufficient engine and boiler capacity to add two additional "K" dynamos. The dynamos are connected in multiple arc to the conducting lines, and either one can be instantly thrown out of use.

The current is conducted from the dynamos to the HERALD Building through 400 feet of electric tubing, 350 feet of which is laid underground through Ann street. There is also about 170 feet of electric tube in use in the HERALD Building, comprising a horizontal and vertical main.

We have wired the building, and placed fixtures for 682 lamps, which are located as follows:—

BENNETT BUILDING.—Engine and boiler rooms, 9.

HERALD BUILDING.—Sub-basement—Press room, 18. Basement—Folding room, 41; stereotype room, 40; machine shop, 10. First story—*Telegram* office, 71 HERALD counting room, 61. Second story—Library room, 92; office and private rooms, 17. Third story—Editorial rooms and office, 47. Fourth story—*Telegram* composing and editorial rooms and HERALD city editor's rooms, 58. Fifth story—HERALD composing room, 103. Sundry halls, closets, &c., 18; reflector for lighting large news bulletin outside, 13. Total "A" lamps, 682.

The plant was started on Monday, September 4, 1882, and has been in use every night since. The average number of lamps in use every night, except Saturday, is 345; on Saturday night 400. The greatest number of lamps are in use from twelve o'clock midnight until two A. M., when the HERALD is being made up and going to press.

"Can there be any danger in using the Edison light, Major?" the reporter inquired.

"Absolutely no danger," the Major replied. "Our current is only 110 volts. That of the arc light, which killed a man the other day, is 2,100."

"About the price?"

"It is believed that we can supply our light at $1 per 1,000 candles. This is about the price of ordinary gas. We rely upon the electric light to introduce itself when on a par with gas as to price."

2222

the firm of Messrs. Denny Brothers, a large number representing various shipbuilders and ship owning interests in Glasgow and the neighbourhood, expressed their great satisfaction with the general arrangement of the wiring, fixing, and of the electrical plant and the general compactness of the arrangements of the engine and dynamo, as well as of the steadiness and uniformity of the light. The candle power of the lamps was controlled with the greatest accuracy by means of an electromotive force indicator, placed in the dynamo room, which indicates by ringing a bell when the electromotive force rises one or two volts above the normal, and then by controlling the speed of the engine, which can be easily done, as it is indicated by a speed indicator, the electromotive force is reduced to its proper amount.

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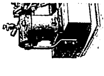

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Messrs. Willans and Steevens' annular space water-heaters, which we have already illustrated and described in this journal, and which has now been long in successful use.

The engine is fitted with a handy arrangement of stop-valve, whereby, if required, steam can be admitted into the low-pressure cylinder for starting the engine with the cranks in any position, the peculiarity of the arrangement consisting in the fact that the steam so admitted (as all other steam) has to pass through the throttle valve. This simple arrangement removes a difficulty which has been experienced with some compounds, as an engine so fitted can never overrun, whatever may be the position the starting valves are left in.

The governor, of which the illustration sufficiently shows the design, is of the high-speed type, running 200 revolutions per minute, and efficiently controls the engine. The boiler is of large size, as is also the fire-box, so that wood, sawdust, and refuse can be burnt. The boiler is machine rivetted. The ash-pan is fitted with a damper at both front and back, and the fore pedestal is made to serve the purpose of a water-tank. In some cases provision is made for oiling each crank-pin by a fixed lubricator, having hanging from it a wick, which is touched at each revolution by a wiper on the connecting-rod oil-cup, thus each time taking off a drop of oil. This plan, which has long been used in marine practice, is convenient when the engine has to make long runs without stopping. The engine illustrated is of substantial proportions, and all wearing parts are made strictly to gauge, so as to facilitate renewals.

THE HAARLEM RIVER BRIDGE.

(*Concluded from page 496.*)

WE this week complete our illustrations of the bridge* over the Haarlem River at Eighth Avenue, New York, with a two-page plate, showing the turning gear for the central swing span. Fig. 32 is a plan of the arrangement, and Figs. 31 and 32 are axial sections at right angles. Upon a cast-iron base ring is placed a circular roller path, and around its edge is bolted the toothed circle shown in Figs. 30, 31. The rollers are connected to a ring placed around the cast-iron socket in which the centre rests, by means of rods converging radially. The upper roller path is attached to the ring girder which carries the superstructure of the bridge. The drawings show clearly the arrangement of the engine, boiler, water tanks, &c., as well as the mode of transmitting the power required for turning the bridge. The engine, which has two cylinders

* See ENGINEERING, pages 450, 451, 452, and 495 *ante*.

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The Edison Company for Isolated Lighting,

65 Fifth Avenue.

New York, December 30th, 1882.

Dear Sir:

At a meeting of the Stockholders held this day an increase of the Capital Stock of the Company from Five Hundred Thousand Dollars ($500,000), to One Million Dollars ($1,000,000), was authorized. In accordance with the terms of the Company's circular of the 6th inst., Stockholders are entitled to subscribe to this increased Stock to an amount equal to the shares of the present Capital Stock standing in their names, on the books of the Company, at the closing thereof, at the Central Trust Company, on the 4th of January next.

This option to subscribe to the increased Stock will be open to Stockholders until the close of business on Wednesday the 10th day of January next, on which day any amount remaining unsubscribed may be disposed of as may be directed by the Board of Trustees.

If you desire to avail yourself of this privilege, please sign the enclosed form of subscription and forward the same to reach this office before the expiration of the time limited above, *together with check for Fifty (50) per cent. of such subscription.*

By order of the Board,

C. GODDARD,

Secretary.

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MONDAY, DECEMBER 18, 1882.

Boston Sunday Herald

THE EDISON LIGHT.

Success of the Incandescent System in Boston.

Herald Building and Bijou Theatre Lighted.

Stage Footlights Forever Dispensed With.

It has already been made public, in anticipation, that the HERALD building was to be lighted by the Edison incandescent electric light. The building, however, is not yet fully lighted in this way, but the composing room and a few of the editorial rooms are now lit by the incandescent electric lamps to the number of 250. The trial lighting occurred on Tuesday evening of last week, and was most successful. Since that time these lights have been run regularly every night, the power being furnished by a Lawrence engine, situated in the basement of the new extension, and converted by a single dynamo placed near it, the current being carried throughout the building by insulated copper wires. The lamps are under perfect control, and can be handled in a measure like gas—that is, the electricity can be turned on or off at pleasure. The light itself is excellent, much superior in illuminating properties to gas, and has none of the white, intense glare and shadow-producing qualities of the arc light, which system had been in use in the composing room and elsewhere in the building for the past two or three years. The compositors are very much pleased with the new light, and regard it with the highest favor. Having to use their eyes as much as their fingers in the work of transmuting writing—and sometimes very poor and indistinct writing at that—into metallic words and sentences, they can fully appreciate a light like the incandescent, which aids them so materially in the work of deciphering "copy," and takes a good deal of the strain from their eyes. They speak of it, therefore, in terms of the warmest and most unqualified commendation, as a thing that aids them very materially in their arduous night working. But the consequences of the new system are not confined alone to the

RELIEF OF THE VISUAL ORGANS.

They are more far-reaching, and, if anything, of much greater importance to the human economy. In a warm office like the HERALD composing room, large though it is, and having a comparatively immense air space or area, the lighting of so many gas jets as are necessary would soon produce an oppressive atmosphere, no matter how well the apartment might be ventilated. The air would be robbed of a large portion of its oxygen by this combustion, and the men working in it must necessarily suffer to a degree for the proper amount of oxygen to support life in its fulness. In the winter season, when it is necessary to keep windows closed, this condition of things is apt to prevail to a greater or less extent in all composing rooms, and any system that will furnish a good light, and yet take nothing from the vitality of the air, is indeed a boon. In the summer season, when windows can be opened, the vitiation of the air by gaslight may be overcome by fresh currents of air admitted through the windows; but what will temper the great heat which is radiated from the jets of burning gas? Those who have for years submitted to the torture of the brain-frying process under gaslights can tell what this heat is, and the feeling of lassitude and nervous prostration it often induces. When the arc light was introduced into the HERALD composing room—though it had its drawbacks—the immunity it gave from gas heat caused it to be regarded with great favor. It need not be said, then, that the newer and better light, where each man can have a light of his own, without the heat of gas, and yet, like gas, in a measure, though far superior to it, is a great favorite, and that printers and editors who use it are unqualified in their praises of it. And it appears to be worthy of all they can bestow upon it in this way, and, when it shall be more widely adopted, people generally will better appreciate it, for in a hygienic, as well as an economic sense, this incandescent system of electric lighting seems destined to play

A VERY IMPORTANT

and beneficent part in the future. In workshops, offices and factories, even beyond its importance as a means of lighting without vitiating the atmosphere, there will be the immunity from liability to produce fires and conflagrations which it will guarantee, and which in itself must be of great economic value. Not only will crowded factories and workshops be made less risky to occupants from bad air and the danger of catching fire, but our places of public assemblage, our halls, theatres, etc., will be rendered comparatively safe, and we may no longer go to a place of amusement with the boding fear of panic and destruction bearing us company. This may to an extent be illustrated in that charming little pleasure resort, the Bijou Theatre, opened to the public on Monday evening last. In this theatre, the introduction of the incandescent electric light has wrought some of the best changes which have come to the aid and illumination of the spectacular drama, and, for that matter, every line of dramatic representation. The apparatus used at this theatre was furnished by the Edison Company for Isolated Lighting for New England, under the charge of Mr. Spencer Borden, the general manager for this section, who, by the way, is a son of Jefferson Borden of Fall River, long known as a prominent business man in that section of the state, and still living at a ripe old age. As was explained in the HERALD of Dec. 10, the current is transmitted through conductors, buried about two feet below the street surface, suitable devices being provided for connecting the tubes and for turning the angles at the various street corners. This line of tubing, which consists of two semi-cylindrical copper rods inclosed in an iron pipe, is continued from the street through the basement of the new Adams House to the theatre, which adjoins the hotel. This tube is about 500 feet in length, and is about three inches in diameter. The conducting rods in the tube are separated from each other, and the space between, and between them and the tube, filled with an insulating compound, like asphalt, which is impervious to water. The conductors enter the theatre beneath

THE REAR OF THE STAGE,

and pass to the northeast corner to a distributing point, from which the circuits to the various points of the theatre converge. At this point are the regulators, one controlling the lights on the arch, a second those in the auditorium, and the third controlling the "fly" or border lights. By these regulators, the lights in each of the above divisions can be raised and lowered at pleasure. Just beyond these regulators is a board on which are placed the safety devices, each separate circuit being provided with an automatic arrangement which affords perfect protection from fire in case of the accidental crossing of the mains. Here also are 11 switches, controlling the lights in various parts of the house. By means of these, the lights in any part of the house can be turned on, lowered down, or shut off entirely. At noon Saturday, by invitation, several newspaper men visited the Bijou Theatre to witness the working of the system. Just inside the arch of the stage there is placed an arch of tin, concaved, so as to reflect the light in different directions. On one side of the concaved surface of this arched reflector, and distributed at intervals all around it, in three rows, are 192 lamps—64 in each row or series. These series are independent of each other, and, by means of colored shades, various effects can be produced much better than by the ordinary footlights, which, by the way, are altogether done away with by this system. Above the stage, between the flies and extending across it, are similar concave reflectors, on which are placed 140 lamps. When these lamps, and those in the arch inside and around the stage arch front, were lit yesterday, there was a perfect illumination of the stage and scenery, and not a shadow was cast by scenery or persons on the stage. It was not only a great relief to the eyes to be able to look upon the stage without having to look across the wearying footlights, but things upon the stage were given a peculiar distinctness and charm which no other light or arrangement of light could give. Instead of coming from below upward, the light came naturally down and from around, and the effect was altogether fine and novel. The reflectors above the stage can be raised and lowered at pleasure. In the auditorium, in the chandelier suspended from the centre of the dome, there are 60 lamps—to be increased to 90. Two smaller chandeliers, suspended from the ceiling on each side near the stage, each contain 18 lamps. In

THE GALLERY AND BOXES

there are 44 lamps, and under the gallery an equal number. There are more lamps over the front entrance and in the main staircase. In all there are 644 lamps of 16-candle power used in the theatre. The exhibition yesterday showed how perfectly each series and all the series were under control—how the lights of each could be turned down, or put out altogether, or turned in a flash into a state of brilliant incandescence. It was indeed marvellous, and all who witnessed it could not fail to realize that Mr. Edison had completely mastered most, if not all, the difficulties in the way of rendering electricity a thoroughly pliable and practicable thing, and no doubt destined to be the illuminant of the future. This is now no mere rhetorical assertion, but a solid and tangible fact, which no one can doubt who sees the effects produced by the light, how easily it is controlled, and how the various details connected with the practical working of the incandescent system have been mastered. After witnessing the effects produced in the theatre the party paid a visit to the place where the engine and dynamo are located. Things were found in working order, but the plant had evidently been very recently laid down, and masons were still at work in the neighborhood of the boiler. It was explained by Mr. Borden that it was only three weeks ago that the work of introducing the light into the Bijou was begun. Everything connected with the work had to be created or placed; but so well equipped was the company for emergencies that, in 15 days from the time of starting, the light was ready to be turned on in the theatre. Near the dynamo is an indicator, consisting of machinery under a small oblong box or cover, beneath which two lamps, of red and green glass, are suspended. These lamps indicate to the man in charge of the dynamo the state of the current. If too strong, the red light shows. If too weak the green light is visible, and he must at once proceed to regulate it, which he does by a switch. When the current is normal—that is, when it is equal to the requirements—neither lamp shows any signs of life.

"How is the current regulated?" asked the writer of Mr. Borden. "When more electricity is produced than is needed how do you manage?"

"But we do not produce more than is needed," was the reply. "Mr. Edison has mastered this, one of the

MOST DIFFICULT OF PROBLEMS,

completely. By an automatic attachment to the generator, as the demand for electricity in the circuit diminishes, the power in the engine is cut down to the minimum required. If, then, there is a quick demand for more light in the circuit, the engine at once responds to it, and more power or energy is converted into electricity to meet it."

"But how about the fires in your boilers; can you stop combustion or start it up as quickly and automatically as you could an engine?"

"No; but fire can be brought under control by means of dampers and other adjustments, or even banked, if need be, and easily started again into activity."

"Still there must be a loss from this source. The next progressive step that I can see in this matter is that your company use gas to run its boilers, and that it manufacture its own gas."

"I have no doubt but gas would be the best and most economical fuel, and a heating gas, like the water gas, rich in hydrogen, and manufactured at a cost of 20 or 25 cents per 1000 cubic feet, would no doubt give the power to convert into electricity at an almost minimum of cost. That is a thing which I suppose will next claim attention, but, as it is, we can produce light by electric incandescence at cheaper rates than the same amount of illumination is furnished by the gas companies, and we can sell it in much the same way."

"Can you measure electricity as you would gas, by meter?"

"Undoubtedly. That is another of Mr. Edison's triumphs. You know that when two pieces of metal are attached in a battery to the positive and negative poles of a current, one will be decomposed in proportion to the strength of the current, and the metal lost by it will be deposited on the other plate—one will gain what the other loses. Well, Mr. Edison deflects a thousandth part of the current through this battery or meter—the plates of zinc being first of an equal weight after a given time, by weighing the heavier it can be easily and accurately calculated; by what it has gained in weight, what amount of current has passed into consumption, and the charge made therefor, as for gas passing through a meter. That question is fully solved."

American Register

Dec 23 1882

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The inventor of the arc light in the Brush exhibition claims to have solved the problem of the storage of electricity upon a commercial basis. His accumulator supported thirty Swan incandescent lights for six hours. It measures ten feet long and the ends are eighteen inches square. The accumulator was charged from the circuit for supplying the streets lights while they continued to burn. Automatic mechanism stopped the current when the process of charging was complete. The accumulator had absorbed ten ampères of current when it was full. Its lighting efficiency, per horse-power of steam, was twenty-nine candles. This accumulator requires only one-third of the space taken by Faure's; while it gives the same results in regard to polarisation. Whether the current will overcome the durability of the plates is not decided; but it is believed that the solution which separates the plates is not destructive. I can only testify that the lamps burned, and that there is no apparent reason to question the inventor's claims. Mr. Edison announces his charges for supplying the electric light to houses at the rate of two dollars for one hour's light equal to two thousand candles. This is equivalent to gas at two dollars per thousand cubic feet.

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L'ELECTRICITE 23 Dec 1883 407

On lit dans le *Scientific American*, journal malheureusement sujet à caution, que le président du chemin de fer Arkenson, Topeka et Santa-Fé a eu une conversation téléphonique avec le directeur de l'exploitation qui se trouvait à l'autre bout de la ligne, en Californie, c'est-à-dire une distance de plus de 4.000 kilomètres.

Notre confrère ajoute à cette nouvelle des détails qui n'ont rien de scientifique et ne sont pas de nature à augmenter la confiance que l'on peut avoir dans ses assertions.

—

On vient d'installer à Berlin dans la Wilhelmstrasse, à partir de l'ambassade anglaise jusqu'au palais du prince Charles, 30 lanternes renfermant chacune 3 lampes à incandescence Edison de 32 bougies.

La canalisation souterraine des câbles Edison est d'environ 500 mètres.

Elle part de la maison 70 *bis* de la Wilhelmstrasse où est placée une compound, machine à vapeur faisant fonctionner une machine pour 250 lampes qui se dirigent à droite et à gauche sur les trottoirs.

Toute l'installation est encore à l'état provisoire.

Influence de la température

SUR L'AIMANTATION

—

M. Berson a étudié l'influence de la température sur l'aimantation dans le fer, l'acier, le nickel et le cobalt. Il place, à cet effet, le barreau à étudier dans un champ magnétique constant, à diverses températures, et compare ses moments magnétiques. Pour comparer ces moments, il a adopté la méthode de Gauss.

Son appareil se compose d'une pile de Bunsen de 6 à 10 éléments, dont le courant, après avoir passé par un commutateur, traverse un rhéostat à charbon de cornue, puis la bobine qui sert à produire le champ magnétique. Un galvanomètre intercalé dans une dérivation permet de maintenir ce courant constant. Dans la bobine magnétisante est placé le barreau, qui dévie une petite aiguille de déclinaison suspendue par un fil de coton à l'intérieur d'une cage en cuivre rouge. Les déviations sont lues au moyen d'un miroir et d'une échelle.

La bobine magnétisante, qui doit être portée à des températures élevées, est constituée par un fil enroulé, sans que les spires se touchent, sur un noyau de verre, et noyé dans un plâtre. Le tout est placé dans une étuve de cuivre et chauffé par une lampe à gaz. La température, qu'on maintient constante aussi longtemps que possible, est mesurée par un thermomètre qui plonge dans l'étuve.

Nous donnerons dans le prochain numéro les résultats obtenus, qui ne font, du reste, que confirmer ce que l'on savait déjà.

DERNIÈRES NOUVELLES

—

Nous recevons de M. W. Lachlan, ingénieur de la *Light and Force Company* de New-York, une lettre relative à l'éclairage d'un quartier de cette ville par le système Edison.

« Vous nous avez demandé par le télégraphe si les travaux Edison avaient échoué, et nous vous avons répondu : « Pas échoué, mais très insuffisants. » En réalité, on peut dire que, dans son quartier du bas de la ville, il a échoué, car il est impossible de donner satisfaction à ceux qui emploient sa lumière ; il n'a jamais osé faire marcher toutes les lumières à la fois, par cette simple raison qu'il ne peut pas le faire avec son système actuel.

« Je vais essayer de m'expliquer : soient C, D, E, F quatre moteurs action. (chacun un dynamo particulier, et supposons que ces quatre dynamos soient groupés en quantité sur deux fils, l'un positif A et l'autre négatif B.

C'est un fait bien connu, que deux machines, quoique absolument pareilles, n'auront jamais un effet semblable et ne marcheront pas également; des dynamos pareils différent encore davantage. Par conséquent, en supposant que tous ces dynamos et toutes ces machines soient exactement de même grandeur et de même valeur en tension et en quantité, si C travaille à toute force et fonctionne seule, elle éclairera par exemple 1,000 lampes incandescentes. Or, si D est mise en mouvement et reliée aux autres machines, dès que D atteindra son maximum de puissance de production, si D est exactement de même force et de même puissance que C, les deux machines réunies éclaireraient 2,000 lampes. Mais supposons que D diminue de vitesse, alors C se déchargera sur D ; si C diminue de vitesse, alors D se déchargera sur C, et toutes les lumières baisseront. Et plus sera grand le nombre de dynamos en travail, plus sera grand le danger de voir l'un se décharger sur l'autre, et ainsi de suite. C'est ce qui explique les plaintes nombreuses sur les abaissements de la lumière, sa couleur jaune, son manque de fixité, etc...

Bien des gens de Fulton street disent que les lampes Edison ne donnent pas autant de lumière que les becs de gaz ordinaires.

La Cie Edison publie continuellement des rapports où elle prétend avoir vaincu toutes les difficultés et marcher bien ; mais de temps en temps les journaux publient des entrefilets où l'on se plaint de la lumière, et de la manière dont elle est fournie. Le secrétaire d'Edison, que j'ai vu, m'a dit que tout allait bien ; mais j'entends des rapports bien différents d'autres côtés.

Nous recevons, par le même courrier, la réponse faite par M. Edison à un reporter du *World*, qui lui adressait les questions auxquelles notre correspondant fait allusion.

« C'est une chose bien connue, qu'il existe à la station de Pearl Street 6 machines dynamiques dont chacune est actionnée par une machine de 200 chevaux. Chaque machine et chaque dynamo ne forment qu'une machine. L'idée était de réunir toute l'électricité engendrée par les 6 dynamos. Quand on a fait l'expérience, cependant, on a trouvé que le résultat n'était pas celui qu'on attendait. Voici ce que dit M. Edison : « En faisant cette expérience, j'ai constaté que, lorsque les courants de deux dynamos étaient réunis, il était impossible de faire fonctionner ces deux dynamos d'une manière douce et égale, par cette raison que, lorsqu'une machine marchait plus vite que l'autre, la machine qui marchait le plus vite prenait tout le chargement de l'autre, et celle qui marchait doucement ne marchait plus que comme électromoteur.

« Le résultat de la première expérience était de nature à étonner les ingénieurs, de même que tous ceux qui y assistaient, et il s'en fallait de peu que cela devînt sérieux. Quand le courant de la seconde dynamo pouvait s'échapper, d'abord l'une des machines, puis l'autre marchaient comme la foudre, et d'abord l'une, puis l'autre étaient converties en moteur. Alors l'un des ingénieurs renversa la vapeur, mais sa machine marchait aussi vite qu'auparavant. Il vint en courant vers moi, pâle comme un mort, et s'écria : « Grand Dieu ! monsieur Edison, qu'est-ce qui se passe? J'ai renversé la vapeur, mais, néanmoins, la machine marche comme la foudre, et je ne peux pas l'arrêter. » En plus des machines de 900 chevaux fonctionnant à grande vitesse, une bobine de 4 tonnes était jointe à chacune qui, effectivement, en augmentait la force jusqu'à 1.000 chevaux. Ensuite, en une seconde, 6 ou 8 livres de cuivre sont fondues ; elles se sont pour ainsi dire évaporées, remplissant la chambre de vapeur et aveuglant presque le monde. Tout le monde s'est précipité vers la fenêtre, à moitié mort de peur. Si toutes les 6 machines avaient fonctionné, je ne sais pas ce qui serait arrivé ; je crois que tout le monde aurait sauté par les fenêtres. Je puis vous affirmer que c'était une affaire sérieuse, et je me suis aperçu de suite que j'allais avoir du mal à vaincre cette difficulté. Mais je voyais ce qu'il y avait à faire pour m'en rendre maître. Le problème à résoudre consistait à trouver un procédé pour que toutes les machines marchent assez bien ensemble pour n'en faire qu'une seule.

« C'est cette nécessité qui a occasionné le retard. Comme un grand nombre de mes clients avaient renoncé au gaz, il fallait bien que nous fabriquions quand même de l'électricité !

« Je me suis immédiatement mis au travail, et j'ai réussi à construire un appareil au moyen duquel *je peux réunir tous les régulateurs automatiques des différentes machines.*

« Je puis affirmer que tous les obstacles sont vaincus. Le quartier dont je m'occupe comportera, lorsque le travail sera terminé, environ 32 kilomètres de fils souterrains dont 15 sont déjà posés et reliés.

« J'ai également perfectionné un mètre pour mesurer la quantité d'électricité usée en un temps donné ; ce mètre est parfaitement exact, parce qu'il n'est pas mécanique, et, par conséquent, pas sujet à se déranger. En outre, la production

The New-York Times, Wednesday, December 27, 1882.

2229

EDISON AND STORAGE BATTERIES.

To the Editor of the New-York Times:

Mr. Hayes, representing the Brush-Swan Company, printed a card in yesterday's papers pronouncing as "incorrect" certain statements of mine published Saturday morning touching the death-current and storage batteries of the Swan-Brush Company. Public interest in the subject compels me to correct Mr. Hayes and set the matter straight.

The Brush arc light current is well known to be deadly. It has killed people, and will kill whomsoever touches the wires. The wires are strung on poles, and are now used for arc lights. Mr. Brush has a storage battery, recently shown here in a neat private exhibition at Mr. Hayes's office, which, it is said, will be brought out for sale and public use in a few months. The Brush-Swan Company proposes to put these storage batteries into private houses and to supply them with current from those Brush arc light wires. The storage batteries thus charged will in turn, it is said, discharge themselves in a feeble and safe current over other interior wires connected with incandescent lamps for domestic lighting.

My Saturday's statement was that the Brush-Swan Company "proposes to introduce these high-pressure currents into houses to feed storage batteries." I believe that statement to be true, and now repeat it. Mr. Hayes might have seen, by a more careful reading of my statement, that it was not the feeble 40-volt current leading *from*, but the fatal 2,000-volt current leading *to*, the storage battery in the house of which I plainly spoke.

The Edison current is throughout his entire system of low pressure, being about one-twentieth the intensity of the Brush current, and is absolutely safe, as thousands of persons know from having freely handled the wires. The Edison system of lighting is meant for interior domestic illumination, and the details in all respects, and especially as regards danger from fire and to the person, have been perfected with that end in view. The Brush system, however, is devised principally for out-door lighting, where the dangerous conductors can usually be kept away from human contact. But it is now proposed to apply this dangerous current to the new business of ordinary domestic illumination.

The Edison Company, as proprietors of an absolutely safe system of domestic illumination, look with deep solicitude upon the possible advent of another system of lighting dependent upon the introduction of death-current wires into the inside of a dwelling or in contiguity therewith. The public will be slow in learning to discriminate between different systems of electric lighting. Should the Brush-Swan wires, which have already killed people in the streets, be touched in or upon a private house, death is certain. It is said, and doubtless truthfully, that the deadly quality of the current is changed by the storage battery, so that, whereas the Brush wires feeding the battery are deadly, the other wires leading out from the battery are safe. This mitigates the evil, but does not cure it. The bad fact remains that the wires leading from the street to the storage battery, wherever located in a house, are death-giving, and these wires, whether passing up or down the outside of the house wall or up or down the inside, must, before reaching the storage battery, be more or less liable to chances of contact. This danger will be more readily seen if I explain what the storage battery is and where it will be placed.

What, then, is the Brush storage battery, and where will the householder locate it? That battery, as shown here last week, is described as a coffin-shaped box 8 feet long, 16 inches wide, and 10 inches high. This box is filled with lead plates, is of great weight, and must be placed where it can be got at for the purpose of occasional treatment. Every house would need to have its own separate battery, and many customers will require a number of these boxes, varying with the amount of light required. In some cases they may be put in the cellar, in others in a closet with a strong floor, but place them where you will the wires leading to them carry the death current. Although every effort be made to keep the covering of these wires unbroken and their location intact, still innumerable occasions will happen, such as house repairs, &c., by which they will be exposed to contact. Whoever touches those wires—it may be a curious child, a stupid servant, a fireman, a workman engaged in plumbing, carpentering, or carrying coal—whoever touches them so as to receive the current will be killed. The public, as I have stated, will not discriminate. If deaths happen from such contact with electric wires, a storm of indiscriminating public indignation will attack all methods of domestic lighting by electricity. It is for this reason that the Edison Company views with deep alarm the possible advent of the Brush-Swan storage batteries, fed in the manner described by Mr. Brush in recent newspaper articles.

S. B. EATON,
President Edison Electric Light Company.
MONDAY, Dec. 25, 1882.

Dec 19/1882

GUTENBERG-JOURNAL

ÉTUDES SUR L'ÉCLAIRAGE ÉLECTRIQUE

L'ÉCLAIRAGE DES THÉATRES 2230

Brünn, novembre 1882

Pendant que les directeurs de théâtres, les municipalités et même les gouvernements de tous les pays s'occupent de la question brûlante (sans calembour) de l'éclairage des théâtres, une ville de la Moravie, peu importante par rapport au nombre de ses habitants, mais grande par l'intelligente initiative de sa municipalité et par le rang qu'elle occupe dans le monde commercial et industriel, a pris les devants en employant, à l'exclusion de tout autre système, la lumière Edison pour l'éclairage de son nouveau théâtre.

Le 14 novembre, date de l'inauguration, fera époque dans les annales théâtrales, et l'émotion qu'ont ressentie ce jour-là les habitants de Brünn était bien légitime. Car malgré les études approfondies auxquelles s'est livrée la commission instituée par la municipalité pour choisir le meilleur système, études qui ont été conduites avec toute la sagacité et toute la compétence qu'un tel sujet comportait, ce projet n'en était pas moins considéré comme un pas des plus hardis tenté dans cette voie.

Qu'il nous soit permis de rendre hommage à la municipalité et surtout à son bourgmestre, M. le chevalier de Winterholler, que l'on est toujours sûr de rencontrer au premier rang quand il y a un progrès à accomplir.

Pour en revenir à l'éclairage électrique du théâtre, nous allons résumer en peu de mots les principaux détails de son installation.

C'est à une distance de 315 mètres du théâtre, que se trouve situé le bâtiment des machines occupant une superficie de 249 mètres carrés et comprenant : 1° la chambre de chauffe à vapeur et 2° la salle des machines.

Les chaudières, au nombre de trois, sont emmurées les unes à côté des autres.

Chaque chaudière est composée d'un bouilleur horizontal et d'un corps tubulaire adapté au précédent; dans ce dernier les tubes sont en quatre groupes; leur nombre total est de soixante-huit.

Deux chaudières étant suffisantes pour l'exploitation normale de la machine à vapeur, il y en a toujours une en réserve.

Ces chaudières, munies de tous les appareils nécessaires de chauffage et de sûreté, sont alimentées par les eaux de la ville au moyen d'une pompe à vapeur fixée au mur.

Les chaudières sont timbrées pour une pression de sept atmosphères, et c'est à cette même pression que se fait l'admission pour la machine à vapeur. La cheminée commune des chaudières a trente mètres de hauteur.

Dans la salle des machines se trouvent, à côté du moteur à vapeur à haute pression d'une force de 110 chevaux, quatre machines dynamo-électriques Edison et trois machines Gramme.

La production de l'électricité dans ces machines est obtenue en faisant tourner à raison de 900 tours à la minute un noyau de fer doux dans le champ d'induction.

Par ce moyen la force motrice de la machine à vapeur se change en électricité et le courant électrique, au moyen d'un câble principal d'une longueur de 315 mètres, est dirigé vers le théâtre où s'opère sa distribution.

Les quatre machines dynamo-électriques Edison sont destinées à fournir l'éclairage de l'intérieur du théâtre; chaque machine peut alimenter 250 lampes à incandescence Edison de la force normale de seize bougies. Deux machines Gramme fournissent l'éclairage extérieur au moyen de cinq régulateurs.

La troisième machine Gramme est affectée à la ventilation du théâtre. Le câble qui relie les machines au théâtre se compose de deux barres de cuivre de forme demi-ronde entourées de matières isolantes et contenues dans un tube de fer forgé qui les préserve de toute influence extérieure. En raison de la tension minime du courant on peut, sans aucun danger, toucher les conducteurs; l'accouplement des tubes du câble est fait d'une façon très ingénieuse.

Ces tubes, ainsi que les machines dynamo-électriques, ont été fabriqués à New-York; la machine à vapeur seule provient d'une des premières maisons de Brünn.

L'intérieur du théâtre est éclairé par huit cent vingt lampes réparties dans la cage du grand escalier, le foyer, les couloirs, la salle, les loges des artistes et enfin la scène.

L'éclairage de la scène présente un intérêt tout particulier : chaque herse supporte quatre-vingt-dix-neuf lampes, dont un tiers est destiné aux effets de lumière blanche. Un tiers est composé de lampes rouges, le dernier tiers de lampes vertes. Tous les effets de lumière peuvent être ainsi facilement obtenus en allumant tout ou partie des lampes de chaque couleur. La rampe supporte cent vingt lampes établies dans les mêmes conditions.

La lumière produite sur la scène par ces différents effets combinés est des plus heureuses; elle dépasse tout ce qui a été obtenu dans ce genre jusqu'à ce jour par le charme inexprimable et le velouté que cette lumière donne à tous les effets de scène. A ce propos nous avons à parler de l'appareil le plus ingénieux et le plus important en ce qui concerne l'éclairage de la scène et de la salle : c'est le régulateur qui est placé dans un coin de la scène; là se rassemblent tous les fils conducteurs, une véritable forêt! Le tout est symétriquement arrangé et n'occupe qu'une place relativement insignifiante.

Grâce à cet appareil, il est possible d'obtenir tant dans la salle que sur la scène depuis la plus éclatante clarté jusqu'à la nuit, en passant par toutes les transitions voulues.

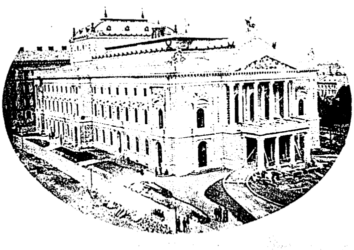
La salle est éclairée par un lustre principal ayant deux rangées de lampes incandescentes.

Le long du pourtour des loges sont installées des appliques portant chacune une lampe enfermée dans un globe dépoli.

Enfin, sous tous les rapports, l'expérience a été concluante. La preuve en est constatée par l'enthousiasme croissant que manifestent toutes les personnes qui s'occupent de cette question.

Chaque jour, des sommités de tous les pays sont attirées par l'intérêt que comporte cette innovation et qui modifie de fond en comble la situation actuelle des théâtres en leur assurant la plus complète sécurité au point de vue des dangers d'incendie; jusqu'à ce jour, cette sécurité leur a fait complètement défaut malgré les nombreuses mesures de précautions imposées aux directeurs par les règlements et qui ont été prises après les terribles catastrophes de ces dernières années.

2231 Brunn Theatre



Charles Batchelor Scrapbook, Cat. 1341

This scrapbook covers the period 1883-1893 and contains clippings about a variety of subjects. Included are articles about Edison's trip to the Paris Exposition of 1889 and descriptions of the exhibits at the Exposition. Other clippings relate to Edison's magnetic ore separator and to his new laboratory in West Orange, New Jersey. Included also are clippings pertaining to the adventures and subsequent disappearance of Frank McGowan, an Edison agent in South America; and to the National Phonograph Company dispute involving Edison, Ezra T. Gilliland, and John C. Tomlinson. There are a few clippings regarding the death of Batchelor's father, James, in 1888 and his mother, Emma, in 1909. The spine is stamped "Scrap Book" and is labeled "1883 1890" and "2232 2508". The book contains 152 numbered pages. The clippings are individually numbered 2232-2508.

Blank pages not filmed: 14-15, 18-27, 32-33, 36-61, 64-99, 102-107, 112-115.

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M. Gaievsky
M. Camille Aveilla
M. l'abbé Holbackzewski
M. l'abbé Constant Adam
M. Fernand Doll
M. Joseph Peterson

M. le prof. Elie Charlier
Mme Augustine Delafontaine
Mme F. Bequelin-Monnin
Mlle Thérèse Bequelin-Monnin
Mlle Adèle Bequelin-Monnin
M. Jules Bequelin-Monnin
Mme Charles Schillmann
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néral Ripley
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. Morau
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ince Poniatowski
rincesse Poniatowski
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-Goddard
de chambre

s Pascale
gliani
el Ernzen
nni Grande
Soldati
Bourdier

Compagnie Générale Transatlantique

2232

LISTE DES PASSAGERS DE CABINE

Embarqués sur le Steamer

"NORMANDIE"

DU HAVRE POUR NEW-YORK

le 3 Mai 1884

M. Robin
Mme Robin
M. le docteur Albertini
Mme Albertini
Mlle Catherine Albertini
Mlle Marie Albertini
Mlle Angèle Albertini
Femme de chambre
Mme Steinbrugger
Trois enfants Steinbrugger
Femme de chambre
M. le baron Daelmann
Mme la baronne Daelmann
Mlle Daelmann
Mme H. J. Clark
Mlle J. Clark
Mlle A. M. Clark
Mlle Fanely Rogeat
Mlle Matagrin
Mme Haviland
Mme Denison
Mlle Denison
Mme James Suydam
Mme L. K. Syz
M. Arthur Rœderer
M. Léonce de Rocher
M. Gustave Boutelleau
M. Ernest Dorval
Mme Dorval
M. Daniel
M. H. Daniel
Mlle Daniel
Mlle de Arozarena

Mlle Arnes
Mlle Klein
M. William Wagner
Mme Wagner
M. William Dock
Mme Amélie Dock
M. Gogorza
Mlle Gogorza
M. L. Perré
M. Emilio Alfonso
M. Ch. Hoffmann
M. Jose Maria Linares
M. Besson
M. Salvador Meje
M. Batchelor
M. Weyer
M. Marco Saeger
M. W. Gardner
M. Lucien Pourquié
M. G. W. Carhart
M. Hughes
M. Joseph Pasquali
Mme Pasquali
Mme A. Garnier
Mme Amanda Bregnard
Mme Anna Bregnard
Mlle Elise Vogel
Mlle J. Lauber
Mlle Kieffer
Mme A. Mancel
Mme Trepannier
M. Paul Fouilleroux
M. François Quellemme

2233

Saloon Passenger List

Per U. S. & Royal Mail S. S. "BRITANNIC,"

From LIVERPOOL to NEW YORK, July 17th, 1884.

COMMANDER: HAMILTON PERRY | SURGEON: W. F. N. O'LOUGHLIN | PURSER: R. N. MUSGROVE

Mr. G. B. Adams
Dr. Asher
Mr. Geo. Atkins
Mr. E. C. Anderson
Master Anderson
Mrs. W. Astor
Miss Astor
and Maid
Mr. J. F. Audit
Rev. T. F. Barry
Mr. G. Blumenthal
Mr. R. Bolton
Mr. Samuel Brown
Mr. J. G. Buckingham
Mrs. Chas. Batchelor
Miss E. E. Batchelor
Miss R. M. Batchelor
Mr. D. D. Bruckerhoff
Mrs. D. D. Bruckerhoff
Mr. P. H. Burton
Mr. A. R. Bingham
Mr. E. G. Burnham
Mrs. E. G. Burnham
Mr. Louis Butterfield
Mr. C. Bragger

Mr. B. L. Cohen
Mr. J. B. Clark
Mr. M. H. Chamberlain
Mrs. M. H. Chamberlain
Mr. John Carson
Mr. C. Caspar
Mrs. C. Caspar
Mr. T. J. Dolan
Mr. F. W. Douglas
Mr. Jno. Earnshaw
Mr. W. Attwood French
Mr. B. Fitzmaurice
Mrs. G. B. Forrester
Mr. Friend P. Fitts
Mrs. Friend P. Fitts
and Maid
Mr. Ellis Goldberg
Mr. F. Graham
Mr. H. R. Goodwin
Mr. R. B. Hunter
Mr. Goold Hoyt
Mr. T. Hook
Mrs. T. Hook
Dr. Max Hildebrand
Mr. H. Hind

Mr. T. Houston
Master Houston
Mr. Ilsley
Mr. Middleton Jameson
Mr. Jacobè
Miss Jacobè
Mr. R. J. Kelley
Mr. Robt. Lenox Kennedy
Mrs. Robt. Lenox Kennedy
and Maid
Mr. Henry Lord
Mr. E. C. Lewis
Mrs. E. C. Lewis
Mr. J. Lindow
Miss A. M. Murray
Mr. Saml. Montagu
Mr. Isaac McCrum
Mr. G. M. Mason
Mr. C. S. Milliken
Mr. John McClung
Mr. McLean
Mrs. McLean
Mr. Lucas E. Moore
Mr. Edward Molson
Mr. J. C. McCarthy
Miss Pickering
Miss M. Pickering
Mr. E. P. Pickering
Mr. W. A. Pillars
Mrs. W. A. Pillars
and Infant
Mr. T. B. Powell

Miss Mabel Phillips
Mr. Samuel Root
Mrs. Samuel Root
Mr. F. R. Robinson
Mrs. J. P. Robinson
Mrs. P. Rothschild
Mr. Cole Saunders
Dr. Brodie Sewell
Miss Sewell
and Maid
Mrs. G. W. Smalley
Miss G. W. Smalley
Mr. D. E. Samuels
Mr. L. Summerfield
Mr. Chas. Sweet
Mr. Russell C. Smith
Mr. G. T. Taylor
Mr. Thibault
Mrs. Thibault
Mr. H. Veith
and Friend
Mr. G. W. Vanderbilt
Mr. F. H. Wright
Mr. W. E. White
Rev. Wm. E. Wolcott
Mr. Le Roy S. White
Mrs. Le Roy S. White
Mr. J. W. Waters
Mr. E. L. Woods
Miss Mary V. Yale
Miss Bina Yale

New York Evening Sun

Dec 22 1884

2234

EDISON'S LIEUTENANTS.

THE MEN WHO HAVE HELPED HIM PERFECT HIS INVENTIONS.

How They Became Acquainted with the Inventor and How They Have All Prospered Under an Unwritten Agreement.

From the day on which Thomas A. Edison got his first appreciable start he has never known the extent of his own wealth. He is undoubtedly worth millions, and his fortune is constantly augmenting. He has always treated his employes liberally, but, so lavish has he been with those who joined fortunes with him when he was poor and obscure, that at least three of them are already millionnaires and several others are approaching that happy stage.

Edison once said to the writer: "Too much honor has been bestowed upon me and too little upon my closest assistants. Without their aid I would have been tormented and hampered and delayed by details, for attending to which I have no earthly fitness. I hope to see this injustice righted some day, and my invaluable associates awarded their just share of public credit."

The first man of present prominence to go with Edison was Mr. Charles Batchelor. Nearly twenty years ago he was sent to this country by the Coates Thread Company of Manchester, England, to put up some newly patented machinery in Newark, N. J. He accidentally fell in with Edison, and entered his service as a mechanic at the bench.

Aside from laboratory and mechanical work, the first serious undertaking of Mr. Batchelor was a trip to Paris in 1881 as Edison's representative at the Exposition. He remained three years in Europe, becoming Edison's agent in the broadest sense, financially as well as professionally. It was he who organized the first Edison company in France, with a capital of several millions of francs. The difficulties attending the task may be partially comprehended when it is explained that he had to erect factories for the making of everything connected with the Edison products. This was necessitated by the French laws, under which patents are not granted for any article manufactured outside of that country. He also organized a company in Italy with a capital of $600,000, and one in Germany capitalized at $1,250,000.

On his return to this country Mr. Batchelor was made General Manager of Edison's enormous machine works which supply most of the materials for the Edison inventions. He is also a director in the Edison Electric Light Company and the Edison Company for Isolated Lighting.

When Edison removed his plant from Newark to Menlo Park he made a verbal contract with Mr. Batchelor, which has never been reduced to writing, agreeing to give him a one-tenth interest in the profits of all the products of the laboratory. A strange feature of these unwitnessed and unrecorded partnerships, of which there are several, is that none of the partners has ever asked an accounting of the others. Each attends strictly to his own department and receives from and pays over to the other partners quarterly dividends in the shape of big checks, about which no questions are ever asked. There has never been the slightest financial difference or disagreement between them. Mr. Batchelor's interest embraces "everything between the dynamo and the lamp," including the lamp factory, machine works, quadruplex, telephone, phonograph, electric light, and electric motor.

Edward H. Johnson, the first American electric expert to join Edison, is now President of four companies—the Edison Electric Light Company, the Edison Company for Isolated Lighting, Bergmann & Co., electrical machinery manufacturers, and the Sprague Electric Railway and Motor Company. He was sent to England, where he organized the Edison Electric Light Company, now known as the Edison-Swan Company. He also formed the Edison Indian and Colonial Electric Light Company.

In the winter of 1869 Mr. Johnson met Edison, while examining as an expert a telegraphic enterprise. He has since been uninterruptedly associated with Edison, never so much as an assistant in the laboratory as a representative in the field, introducing and putting into practical operation the various inventions.

Mr. Johnson first became known in New York as the General Manager of the Automatic Telegraph Company, and so continued until the invention was sold to Messrs. Gould and Eckert of the Atlantic and Pacific Telegraph Company, of which company he then became Assistant Electrician, Edison being Chief. Mr. Johnson had charge of the Edison exhibit at the Centennial Exposition, to the completeness and splendor of which thousands can testify. Mr. Johnson then travelled in this country, lecturing on and giving illustrations of the wonderful powers of the telephone.

In 1879, when the telephone had been finally accepted by the Western Union, Edison sent Johnson to England to put it into practical operation there. Mr. Johnson made several trips subsequently to England and assisted Mr. Batchelor in organizing the English company. He also represented Edison at the Crystal Palace Exhibition in London.

Mr. Johnson's career has been a remarkably varied and active one. He was born in Chester county, Pa., considerably less than forty years ago and attended a country school until he was 12 years of age. He then became a telegraph messenger and student at West Chester intersection, now known as Malvern station, under that famous old-time railroad operator, "Davy" McEachren, at present ticket agent of the Pennsylvania Railroad Company at Huntingdon, Pa. As an operator young Johnson became a warm friend of the late J. Edgar Thomson and Col. Thomas A. Scott.

Mr. Sigismund Bergman ranks third in the list of Edison's assistants. When he came from Germany he could not speak a word of English, but he somehow managed to get acquainted with Edison. His work "talked," even if his tongue halted, and, being a trained mechanic, he went to work as such at the bench in Edison's Newark shop soon after Mr. Batchelor had accepted a similar situation.

In 1875 he opened a shop in a small front room at 191 Wooster street, his family occupying the rear rooms. Here he proceeded to manufacture electric bells, burglar alarms and similar small work, his force consisting of one man and two boys.

When the phonograph had been invented, and Johnson was casting about for some one to make the instruments, Edison recommended Mr. Bergmann. This led to a business partnership and personal friendship between Johnson and Bergmann, which will last as long as both men live. Mr. Bergmann made the phonograph so promptly and of such superior quality that he secured all subsequent similar work, and to this day continues to make all of that class of instruments.

While Johnson was in England he advertised for bids for the construction and delivery of a large number of telephones. Replies were received from the Siemens, the Silvertown and other celebrated works, but none was satisfactory. He thereupon cabled to Bergmann, who submitted a proposal lower in amount and to be delivered in a shorter time the intervening ocean notwithstanding. Mr. Bergmann then received a further order from England for 2,000 telephones, or $120,000 worth of work, and executed his contract satisfactorily and within the specified time. He was so pleased with Johnson's good offices in the matter that he gave him outright a one-eighth interest in his business. On his return to this country Mr. Johnson purchased an additional three-eighths interest, making him a full partner. Edison was subsequently admitted to membership in the firm, dividing it into thirds, and Mr. Batchelor's partnership with Edison gives him also an interest. This plant is now estimated to be worth $800,000.

One of the most remarkable men in this aggregation of intellect is John Kreusi. No contribution to current scientific literature would be just or complete that omitted honorable mention of Mr. Kreusi. He is a native of Switzerland. He is a partner in the machine works and the tube company, and is manager of these two consolidated companies, ranking next to Mr. Batchelor.

When Edison and his assistants have puzzled over a problem until their heads are splitting, trying to find a missing link or endeavoring to figure out from insufficient data whether a new invention is likely to prove anything more than a mere toy, the invariable refuge is "Let's ask Kreusi." In such cases his instinct has proved unerring and his judgment well nigh infallible. His modesty is excessive and it would cause him positive pain to know that his name was to be lauded in print. In every respect he is a quaint and lovable old man.

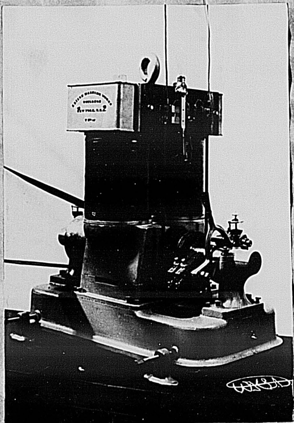
The only college graduate among the forces is Francis R. Upton, a native of Massachusetts, who came to Edison in 1879 as a mathematician to work out problems in connection with the electric light. He is now a partner in and General Manager of the lamp factory, and also a director in the Edison Electric Light Company and the Edison Company for Isolated Lighting.

Among other young Americans who have gained fame and wealth through their connection with Edison is John W. Lieb of Newark, N. J., General Manager of the Italian Edison Electric Light Company at Milan.

Philip Seubel of New York city is another. He is the principal engineer of the German Company. Among his other experiences was the fitting up with the electric light of the two theatres in the palace of King Ludwig of Bavaria, the crazy monarch who committed suicide.

Francis Jehl, also of this city, did his first independent work for Edison in Europe when he fitted up the new theatre in Brunn, Austria. He is now in charge of the district surrounding Bucharest.

6 2237



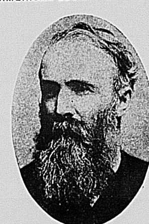
2238

IX.—No. 6. PHILADELPHIA, JUNE, 1887. 10 CENTS A COPY

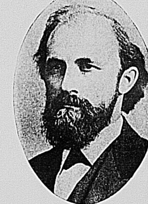
2239

PRESIDENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

R. H. THURSTON
APR., 1880—NOV., 1882

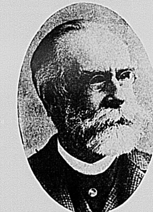


E. D. LEAVITT, JR.
NOV., 1882—NOV., 1883.



JOHN E. SWEET.
NOV., 1883—NOV., 1884

JOHN F. HOLLOWAY.
NOV., 1884—NOV., 1885.



COLEMAN SELLERS.
NOV., 1885—DEC., 1886.

GEORGE H. BABCOCK.
DEC., 1886—

2240

COPPER PRODUCTION OF THE WORLD.

The production of the copper mines of the United States has been trebled during the past eight years, and since 1883 this country has been the greatest copper producing country in the world. We no longer hold the position of attempting only to supply the home market, but have taken the field as active competitors for the export trade, and copper must hereafter occupy an important position in the settlement of our trade balances, if the yield of the American mines is to continue increasing as of late years. Messrs. Henry R Merton & Co., of London, have prepared the following table, showing in gross tons of 2,240 pounds each, the output of copper for the principal countries of the world since 1880:

Countries.	1880. Tons.	1881. Tons.	1882. Tons.	1883. Tons.	1884 Tons.	1885. Tons.	1886. Tons.
Algiers	*500	*600	*600	*600	250	250	110
Argentine Republic	*300	397	800	293	159	231	180
Australia	9,700	10,000	*11,000	12,000	14,100	11,400	9,700
Austria	470	455	*455	*500	670	585	550
Bolivia—Coro-coro	*2,000	2,655	3,255	1,640	*1,500	*1,500	*1,100
Chili	42,919	37,080	42,909	41,049	41,048	38,500	35,025
Cape of Good Hope	5,038	5,087	5,400	5,000	5,000	5,470	6,315
England	3,662	3,875	3,464	2,640	3,350	2,773	*2,500
Germany—Mansfeld	9,800	10,919	11,516	12,643	12,582	12,450	12,505
Other German	1,030	1,743	*1,800	*2,000	*2,200	*2,800	1,870
Hungary	*970	970	*570	620	800	*800	*700
Italy	*1,380	*1,480	*1,400	*1,600	1,325	835	900
Japan	*3,900	*3,000	*4,800	*7,000	*10,000	*10,000	*10,000
Mexico	*400	333	401	440	291	375	270
Newfoundland	*1,500	1,718	1,700	1,653	668	778	1,125
Norway	2,426	2,640	2,700	2,642	2,782	2,760	2,220
Peru	*800	615	440	395	302	229	75
Russia	3,300	3,700	4,000	4,400	4,700	5,100	4,875
Sweden	1,074	995	708	732	642	775	*600
Spain & Portugal							
Rio Tinto	16,215	16,636	17,384	20,472	21,504	23,484	*24,700
Tharsis	*9,151	*10,223	*9,000	*9,840	*10,800	*11,000	*11,000
Mason & Barry	*6,003	*8,170	*8,000	*8,000	*7,500	*7,000	*7,080
Sevilla	1,705	1,340	1,885	2,023	2,000	1,850	2,135
Portuguese	1,000	1,410	1,700	2,357	2,400	1,695	1,258
Other mines	1,030	1,469	1,580	1,952	2,251	2,324	3,500
United States							
Lake Superior	23,200	24,350	25,440	26,650	30,725	32,210	35,560
Montana	....	....	1,015	11,010	19,255	30,270	25,720
Arizona	2,810	6,532	8,030	10,690	11,935	10,135	6,085
Other States	..	.....	2,455	3,270	2,785	1,435	1,510
Venezuela	1,800	2,823	3,700	4,018	4,600	4,111	2,708
Total	151,065	164,030	181,438	198,341	218,774	224,427	212,558

* Estimated.

The average visible supply on the first of each month during the same years, and the average price at the same time have been as follows:

	Average Visible Supply, Gross Tons.	Average Price per gross ton £	s.	d.
1880	64,151	63	1	3
1881	59,703	61	1	3
1882	51,417	67	0	6
1883	50,111	63	8	9
1884	45,012	54	15	6
1885	55,220	44	1	6
1886	61,314	40	6	0

The figures given in the first table for Mexico are undoubtedly incorrect, and do not include about 600 tons produced by the Boleo and other companies. The total production last year fell a little below 1885. The output of the mines of this country in 1886 was 69,805 tons, or nearly 33 per cent of the yield for the world. As will be seen by the second table there has been a very heavy decline in the price of copper since 1882, amounting to over one-third of its value at that date.

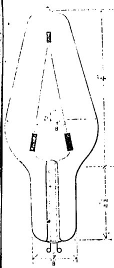
1883

London Engineer Sept 21

2241

The Gérard lamp ~~is quite new~~. ~~It~~ is shown in the annexed sketch as designed for from 150 to 200-candle power. There are two straight carbon filaments of circular section, about ½ mm. or less in diameter. These are joined at top as shown by a small cylindrical lump of carbon, in which they are cemented by carbon paste. The lower ends are similarly cemented to two larger cylindric lumps of carbon, where the connections are made with two stout platinum wires. These are led down through a thick stem of specially prepared enamel, in which they are embedded. They end in a couple of eyes formed by bending them round, and the coupling to the holder is made in a very similar manner to that of Swan's lamp. In the larger sized lamp, which is said to give from 400 to 500-candle light, there are four exactly similar carbons coupled in the above manner in two pairs, and through which the current runs in series, the junction between the pairs being made by a short cross piece of some carbon stick, and this junction hanging free in the vacuum, so as to allow free expansion of the whole - see Fig. 7. The electrical dimensions given are -

FIG. 6.



Candle-power.	Electro-motive force. Volts.	Resistance hot. Ohms.	Resistance cold. Ohms.	Current. Ampères.	Volt-ampères.	Volt-ampères per candle-power.
150-200	56	8	20	7	392	2 to 2·6
					Higher limit	
400-500	56-75	6¼ to 7½	19	7·5 to 12	900	1·8

One of this latter large power has been tried with a 7 to 8 ampères current for 600 hours, and found to hold out without signs of injury. The experiments are at present being continued. Another was tried with an 18 ampères current, when the platinum wires melted, but the carbons remained intact. The long narrow base of the glass globe has for object the diminution of temperature of the glass where it joins the socket. The carbon sticks are Carré carbons, made by squirting a paste of powdered coke through a tube, and baking the rod thus obtained. To make these suitable for incandescent lighting the sticks so prepared are further carbonised by depositing carbon on their surfaces from a hydrocarbon gas, in which the sticks are held while a current is passed through them to bring them to a white heat. This process is continued until the desired resistance for the lamp is obtained, the resistance being measured from time to time as the deposition proceeds. It was found very difficult to find a paste with which to cement together the upper and lower ends of the straight sticks, which would endure the high temperature sufficiently long. A very large number of substances was tried before the one now used was decided upon. This and the next lamp we describe are among those that cannot be said as yet to have been officially tested. The above numbers are given on the authority of the makers.

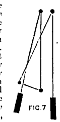


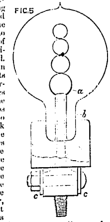
FIG. 7

The lamp of Mr. Müller, of Hamburg, has been in the market for some time. It is made in various sizes, from 2 up to 100-candle power. We give the measurements of what is termed the 20-candle lamp, made by Mr. F. Uppenborn, of Mr. S. Schuckert's establishment, whose accuracy may be relied on -

Candle-power.	Electro-motive force. Volts.	Current. Ampères	Resistance hot (deduced from electro-motive force and C.)	Volt-ampères.	Volt-ampères per candle-power.
18·5	105	·75	140	78·8	4·17

The carbon filament is in this lamp twisted to the form of a double spiral, its ends being cemented to two tapering horns of enamel *a* wrapped round the upper ends of the platinum wires, and fused to the top of a stout stem of glass *b*, in which the platinum wires are embedded. The whole is inserted in an ebony holder, which has at its base a tapered screwed portion. The platinum wires are led down through the ebony to two small flat brass plates *c c*, which are held to the sides of the ebony block by a bolt and nut also made of ebony. The larger sizes have two turns of the double spiral, giving the appearance of three loops, as in the figure, while the smaller have one and a-half or only one turn. For all sizes up to the ordinarily used one, namely, 20-candle power, the filament is evidently made as thin as possible, and apparently of about the same diameter for all sizes up to this limit, the lengths being less for smaller candle-power. For the large powers the carbon is made much thicker but very little longer.

FIG. 5



London Engineer Sep 21 1883

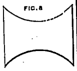
After He Laughed.

A man once indulged in great laughter
At the sight of a boy on a raughter.
He was perched up quite high,
But came down on the fligh,
And his hat it fell tumbling aughter.

The Bernstein lamp is creating more sensation than any other at the Exhibition. Mr. Bernstein considers that, other things being equal, the greater the surface of the light-radiating solid, the pleasanter and more efficient will be the lamp. There can be no doubt about the greater pleasantness to the eye due to the less concentration of the light source. There is much debate, however, as to the unmitigated advantage of a large surface. The greater the surface, it is argued, the quicker is the cooling effect; and, as the temperature to which the filament is raised depends on the ratio of the rate of generation of energy to the rate of cooling, it is inferred that a lamp with a comparatively large filament surface cannot attain a high temperature, and therefore cannot be economical as a light producer. We cannot say that we think this argument a safe one. The rate of cooling by conduction or by connection would certainly be proportionately greater with greater surface; but it has to be remembered that the cooling here takes place wholly by radiation, and when the radiating surface is a completely closed one, and not merely a portion of a larger surface, we expect that the total amount of radiation at a given temperature does not increase so rapidly as in direction proportion to the extent of that surface. If Mr. Bernstein's measurements of his own lamp are correct, which is very doubtful, it shows it to be extraordinarily economical as a light producer from mechanical energy.

The mode in which the inventor sought to attain the above object was to make the carbon hollow while not increasing its cross-section, an idea that has probably occurred to many, but which no one has heretofore carried out with practical success. He made many experiments with straw, and with carbon cylinders produced by depositing carbon on a metal mandril and then dissolving the metal out. At the time of his American patent he considered paper to be the best material he could use. This he rolled round a mandril, making the different layers adhere by a weak solution of gum or starch, which readily carbonise in the subsequent baking process. The thickened ends required for the carbons were produced by cutting the sheet of paper to the shape shown in the annexed sketch. The tubes thus produced were baked in a plumbago crucible packed round with powdered plumbago, and the baking took place at a white heat. The contraction was found to be very great, and on this account, and because greater homogeneity can be obtained with the now-used material, paper has been abandoned in favour of a finely woven cotton or silk fabric. The tubes thus produced were straight, and were stretched between two platinum wire terminals.

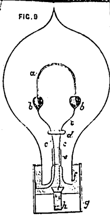
FIG. 8



Later improvements have made it possible to produce these fine tubes in the form of an arch, and more remarkable still is the fact that this arch has a very large range of pliability. It can be stretched almost straight out when cold, and will spring back exactly to its original form. This elasticity is, of course, a characteristic of the highest importance in an incandescent lamp

carbon. The glass globe is spherical in form, drawn and sealed at the top when the vacuum is made. It has a long cylindrical base to prevent the temperature rising too high at its junction with the gypsum; *a* is the hollow carbon tube, cemented with a special carbon paste, the composition of which is kept secret, to very large pear-shaped terminals *b b*. To these are attached stout copper wires *c c* leading down through the enamel bridge *d* and the enamel stem *e*, the one wire to the brass screw *h* and the other to the outer brass tube *g*. The glass globe is cemented in this brass tube *g* by the means of gypsum *f*. The holder is a round block of wood, in the centre of which a brass tube, screwed internally, screws on to *h*. Small strips of brass, with a tendency to spring outwards from the cylindrical surface of the wood block, come in contact with the interior surface of the tube *g*. To the outside of the wood block connections are made by stout copper wires to these external and internal contact pieces. The contact is not directl[y] made, but by means of a small wedge-shaped plug whi[ch] fits between two flat obliquely set spring plates, [h] which is pressed outwards out of contact by a small sp[iral] spring.

FIG. 9



small buttons. The electric dimensions of this lamp are:

Candle-power.	Electro-motive force.	Current.	Resistance hot.	Volt-ampères.	Volt-amp[ères] per cand[le] power
65	23	7	3·3	161	2·5

A larger size is also exhibited, giving about 150-can[dle] power with 46 volts. The resistance has not yet been v[ery] accurately measured. Mr. Bernstein has designed [his] lamp for a small E.M.F. on two grounds; firstly, becau[se] it has been practically proved that the carbon disintegra[tes] with a rapidity greater in proportion to the E.M.F.; a[nd] secondly, because the small E.M.F. permits a large nu[m]ber of lamps to be arranged in series. He claims t[hat] it is especially suited for separate installations, such [as] that of a theatre, a large workshop, or a large shop, [and] also for street lighting, but it must not be forgotten [that] Mr. Bernstein is working in direct opposition to the d[irec]tion taken by other makers, who all favour high re[sist]ances, and high electromotive force, because with t[hese] alone can the cost of long leads be kept down. T[o put] this in another form, we may point out that the gr[eater] the pressure at which water is delivered, the smaller [the] pipe that will suffice to transmit a given power. I[n the] same way the higher the E.M.F. the less in diameter [need] be the leading mains from the dynamo. These lamp[s are] at present only made in Boston, but it is intend[ed to] establish a manufactory of them in Europe shortly.

Consulate General
of the United States of America

2242

5, Rue Scribe.

Paris May 21st 1884

To the Honble
The Collector of
New York.

I beg to certify that Mr. Charles Batchelor - the Representative of Mr. Thomas A. Edison in Paris, has been in Paris as a resident with his family since the Electrical Exhibition of 1881, & his wife for a year longer. In this time, they have accumulated a moderate quantity of household effects, which Mr. Batchelor is about to ship to New York in seven or eight boxes. These [illegible]

has already returned to the United States. Mrs. Batchelor thinks the contents of these boxes not important enough to require a consular declaration, & I, therefore, write this letter to say, that I have known Mr. Batchelor before & during all the time of his residence in Paris, & beg that the entry of his effects may be properly facilitated at the Custom house.

With high respect

I have the honor to be

Your obt servt

[illegible]

Consul General

2243

OFFICE OF THE EDISON ELECTRIC LIGHT COMPANY,
NY World
16 AND 18 BROAD STREET,
NEW YORK, Feb. 2, 1887.

Notice is hereby given that a special meeting of the stockholders of the Edison Electric Light Company will be held at the office of the company, 16 and 18 Broad st., New York City, on TUESDAY, the 1st day of March, 1887, at 12 M., to determine whether the capital stock of the company shall be increased from 12,342 shares of $100 each, to 16,000 shares of $100 each. A proposed contract about to be entered into between the Edison Electric Light Company and the Western Edison Light Company will be submitted to the stockholders of this company at said meeting for their consideration.

For the purpose of said meeting the transfer books of this company will be closed on the afternoon of Feb. 7 and reopened on the morning of March 2, 1887.

EDWD. H. JOHNSON, JOHN C. TOMLINSON,
ERASTUS WIMAN, C. H. COSTER,
SPENCER TRASK, F. S. SMITHERS,
THOS. G. BUCK, ANTHONY J. THOMAS,
NOAH DAVIS, CHAS. BATCHELOR,
A majority of the Board of Trustees.

2244

2245

AN ELECTRIC BOOM.

1887

Westinghouse Stockholders Ratify the Consolidated Company Deal.

AGGRESSIVE WARFARE TO BE WAGED

Against Infringing Companies, and a Virtual Monopoly is Claimed 1887 — X

FOR THE INCANDESCENT LIGHTING SYSTEM

The stockholders of the Westinghouse Electric Company, at an important meeting held yesterday afternoon, ratified the recent deal with the Consolidated Electric Light Company of New York. This is one of the most important electrical transactions ever consummated in this country, and, it is claimed, gives the Consolidated Company a virtual monopoly of incandescent lighting. Mr. Westinghouse, President and organizer of the Westinghouse Electric Company, and now President of the Consolidated Company, read the following report of the transaction, which was unanimously ratified by the stockholders. The report was as follows:

I take pleasure in informing you that an agreement has been consummated between your company and the Consolidated Electric Light Company of New York, by which an alliance of the greatest importance and advantage to this company has been formed. The facts are as follows:

The incandescent in its present commercial form is a modern invention, the title of which for a period of several years was fiercely contended for in the Patent Office by Thomas A. Edison and Messrs. Sawyer and Mann. The contest was finally decided in favor of Sawyer and Mann. The title to this and other important patents was vested in the Consolidated Electric Light Company, which proceeded at once to bring suits for infringement against the Edison, the Brush-Swan and United States Electric Companies, all of whom were making and selling incandescent lamps. In the meanwhile, the Sawyer-Mann invention was patented in England. The Edison Company bought this English patent through an agent, brought suit on it and sustained it, and thereby obtained in England a substantial monopoly of electric incandescent lighting. Your company being engaged in the manufacture and sale of incandescent electric lamps, for use with its electrical apparatus, I proceeded to acquire for your company such an interest in the Consolidated Light Company as would enable me, safely to the interests of your company, to turn over to it the manufacture of the lamps necessary for use with your apparatus. The result has been the reorganization of the Consolidated Company, in which the interests of this company are represented and fully protected by my election as President and by an equal control in the affairs of that company. Under this agreement the lamp department of your company has been sold to the Consolidated Company, and all the lamps which are necessary to the use of the apparatus manufactured and sold by your company are to be supplied by the Consolidated Company. With

ITS RAPIDLY INCREASING BUSINESS,

the demand of your company for lamps is becoming so large that additional capital would be required and a practically separate organization would be necessary to carry on its lamp manufacture, while, in fact, its entire attention should be devoted to the manufacture and sale of its electrical generating and distributing apparatus, particularly the alternate current apparatus, the growing demand for which is beginning to tax our facilities.

Manifold advantages accrue to your compan under this agreement: Owning the fundame tal lamp patents, the Consolidated Compan will be in position to compel all other comp nies to purchase their lamps from it. Yo company has escaped all liability for infring ment, and will share in the profits of the man facture of the lamps, as well as the recoveri from infringers and royalties from licenses.

On the other hand, the financial condition the Consolidated Company has been material improved, and it is the intention of that co pany to prosecute vigorously all infringers of patents, in pursuance of which policy a suit h already been begun in Baltimore against one Edison's licensees, and other suits will be broug in Pittsburg and other prominent points throug out the country, for the purpose of vindicatin its rights and putting an end to their furthe infringement. If the same success attends the suits as was obtained in the Patent Office again Edison, and by the Edison Company itself England under one of these inventions, t Consolidated Company will obtain a monopo of the business of manufacturing and selling i candescent lamps in this country, a result whi will make the stock of your company in t Consolidated extremely valuable, and put the two companies in a position of control.

THAT EASTERN AGREEMENT.

The Consolidated Company has granted license to the Thomson-Houston Electric Com pany, of Boston, upon a royalty, and under a agreement between the said companies th Sawyer-Mann Electric Light Company, of Ne York, was created and granted the exclusiv right to manufacture and sell incandescen lamps under the patents, excepting the Thomson Houston license. In order to enable the Con solidated Company to resume its manufacture it has bought up and now owns the entire capita stock of the Sawyer-Mann Company, and th necessary steps to the revestment of the sai right in the Consolidated Company have bee taken.

Speaking further of the Thomson-Housto agreement by which their own serious liabili ty for infringment was removed, Mr. West inghouse continued:

It is a matter of common knowledge that have made an agreement with the Thomson Houston Electric Company, whereby that com pany has recognized the validity of our alternat ing current, the Gaulard-Gibbs patent, and ha been granted a restricted territorial licens thereunder. The agreement covers and define the business relations between the compani and gives your company the right to sell the arc lighting apparatus of the Thomson-Housto Company upon the most advantageous term The advantages of this agreement to your com pany are very great. The Thomson-Housto Company is a wealthy and powerful corporatio and is engaged in the manufacture and sale of magnificent arc-lighting system. It has exten sive shops, a corps of experienced aggressiv agents and more than 200 sub-companies sca tered all over the country. It disputed ou patent and had begun a vigorous course of in fringement, and we had brought suit against i By the agreement over 200 possible infringemen companies were turned into possible licensees, long, expensive and wasteful litigation wa averted, large royalties or equivalent payment to us contracted for, the adverse claims of th Thomson-Houston Company were waived and a aquiescence in our legal rights, unheard of i the history of patents with so young a patent was obtained, whereby our legal position ha been enormously strengthened.

INCREASING THEIR FACILITIES.

Since the granting of the patents on th alternating current system, October 20, 18 the Westinghouse Electric Company h been very successful. Up to that date t company had been manufacturing and sel ing plants on the direct current syste only, and had only disposed of but plants, with a total capacity of 2,600 1 candle power lamps. At the date mentione the capital stock of the company w increased and measures taken to manufa ture, on a large scale, not only the lamp but the alternating current apparatus, an commencing with last April, the new sy

Discrepancy here —

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tem was put on the market. Since this time, according to the report of Vice President H. M. Byllesby, read at the meeting yesterday, upward of 80 alternating current plants have been sold, with an aggregate capacity of 138,700 16-candle-power lamps. These are distributed through nearly every State in the union.

By the terms of the agreement with the Consolidated Electric Company the manufacturing portion of the Westinghouse works will be turned over to the Consolidated Company, the old company holding and operating the alternating system works. That these will be materially enlarged and their capacity increased is presaged in the closing paragraph of Vice President Byllesby's report, which read as follows:

"The outlook for the continual growth of the business has been such as to render necessary, to keep up with the demand, the erection of a five-story brick building on that portion of our premises formerly occupied by a small foundry and smith shop. This building is now under construction, and will probably be ready for occupancy by February 1, 1888, and the outlook for business warrants the belief that the entire capacity of our present plant, in addition to the increased facilities of the new building, will be wholly occupied in keeping pace with orders received.

"On November 23 the orders on hand not ready for shipment aggregated $235,000.

"The capacity of the works, including the addition now under construction, will provide a producing capacity of from $300,000 to $400,000 per month."

SPECIAL SUPPLEMENT TO

Mechanics

TO BE BOUND IN WITH A. S. M. E. REPORT FOR JUNE.

[ABSTRACT.]

GASLIGHTING BY INCANDESCENCE.

BY JAMES DREDGE.

[Editor of (London) *Engineering*.]

There are many reasons why progress in the general application of the electric light has been far less rapid in England than in the United States, but only three of the various causes need be referred to here—speculative financing, repressive legislation, and cheap gas. The low price at which gas is distributed in England, varying from 40 cents per 1000 cubic feet to 75 cents, constitutes the most formidable antagonist to the more modern form of illumination, because, with improved and economical methods of producing currents suitable for lighting purposes, the price of gas can be still further reduced, so that it may be predicted that, so far as cost is concerned, it will always defy competition from the electric light for general house illumination.

For several years past, the public has become familar with higher standards of illumination than of old. So while it is recognized that the change to electric lighting is, for some years to come, an impossibility, there is a universal demand for a system of illumination which shall approximate in steadiness and brilliancy to the incandescent light, and which at the same time can be adapted for domestic use.

The successful solution of this problem involves many difficulties.

Before any improved means of illumination adapted for general domestic purposes can be considered successful, a variety of difficult and conflicting conditions must be fulfilled, some of which are as follows:

1. Existing fittings should not be interfered with, excepting so far as burners and their adjuncts are concerned, and no separate system of service pipes must be required.

2. The system must give a better and steadier light than the ordinary gas flame; in other words, the inducement to employ it must be obvious and decided.

3. The cost of new fittings, and of altering existing ones, must be moderate.

4. The management of the system must be as simple as that required for gas, facility of breakage or derangement must be impossible, and the duration of the lighting medium must be so great that the cost of renewals (which must in any case be insignificant) should be inappreciable.

5. The consumption of gas must not be increased, but on the contrary, a very marked saving either in consumption, or its equivalent in increased light must be secured.

6. The combustion of the gas burnt must be more perfect than at the ordinary gas burner, in order to reduce to a marked degree the objectionable and destructive effect of gas consumed in dwellings.

7. The light obtained must remain constant, and not deteriorate with the use of the illuminating medium.

The foregoing are all probably the important requirements attendant upon successful system of gas lighting by incandescence, and if they can be fulfilled, there is no doubt that the introduction of electric light for domestic uses would be indefinitely postponed in countries where gas is produced and sold cheaply.

Auer v. Welsbach.—About 18 months since interest was excited by reports from Vienna, that an Austrian physicist Professor Auer v. Welsbach, had succeeded in producing an exceedingly thin hood or mantle of zirconium oxide, capable of receiving a high degree of incandescence when submitted to the action of heat, without becoming disintegrated, and of sufficient strength to resist the ordinary shocks of service. The English patents bearing on this particular invention, so far as they are made public, are dated December 12, 1885, May 13, 1886, and July 29 of the same year.

In the first specification it is set forth by Professor Welsbach, that his invention relates to the manufacture of an illuminant appliance in the form of a hood, rendered incandescent by gas of other burners. The proportions of the substances used for impregnating the hood, as already described, are given as follows:

60 per cent. zirconia or oxide of zirconium.
20 " oxide of lanthanum.
20 " " yttrium.

or, as an alternative:

50 per cent. zirconia.
50 " oxide of lanthanum.

The claim in this specification runs as follows: "The manufacture substantially as herein described, of an illuminant appliance for gas or other burners, consisting of a cap or hood made of fabric impregnated with the substances mentioned and treated as set forth." In the second patent, dated March 13, 1886, "the use of oxide of thorinum alone, or in admixture with oxides of zirconium, lanthanum, yttrium, neodymium (one of the two metals of which didymium is composed), erbium, magnesium, or aluminium" is claimed. It is asserted that oxide of thorinum produces a good light, and a rigid hood: that a mixture of thorinum oxide and lanthanum oxide in equal proportions produce a yellow light; that thorinum oxide and neodymium oxide produce an orange light, and that thorinum oxide and erbium oxide produce a greenish light. The specification of July 29, 1886 relates to the treatment of the zirconium ore.

The zirconium is reduced to about the size of peas, heated to a white heat under free admission of air, pulverized, levigated, and is then digested for several days with concentrated pure hydrochloric acid for the purpose of removing all traces of iron. The original brownish gray powder is by this means converted into a perfectly white powder, and many of the impurities originally contained in the zirconium crystals are dissolved. The fine zirconium powder is then washed and dried, and is mixed with double the quantity of calcined carbonate of soda, and after being ground fine, it is subjected to a white heat for about three hours in a platinum crucible. The cakes of soda thus obtained are placed in cold clean water, when a fine white powder will be precipitated, while numerous bodies that are not useful pass into the mother liquor. The white powder is washed in water, dried, and treated with sulphuric acid under trituration until a sample heated on platinum clearly shows an excess of sulphuric acid. The decomposition of the white powder by sulphuric acid takes place under considerable heating, and care must be taken that the acid is very gradually added (the powder remaining perfectly dry), as otherwise a scattering of the mass will ensue. The powder is then heated to the boiling point of the sulphuric acid, whereby the greater part of the excess of acid will be driven off. After cooling, the powder is mixed with a large quantity of cold water under stirring, whereby the zirconium will be dissolved as sulphate, together with other bodies. The undissolved precipitate is unconverted zirconium and silicic acid. This is separated by filtration and washed. The solution of zirconium sulphate is precipitated cold by ammonia, and is washed. If this material be now dissolved in nitric acid, so that no considerable excess of acid occurs, a brilliant white powder will after a short time be precipitated, which is a peculiar combination of zirconium, containing this metal in an almost chemically pure condition. The impurities, such as iron, alumina, etc, remain in the lye. This re-action is based on the fact that a small quantity of sulphate of ammonia present in a solution of nitrate of zirconium effects the separation of the compound completely when heated, and partially when cold.

The precipitate containing the zirconium is almost insoluble in water, but is soluble in nitric acid when freshly precipitated; when digested with ammonia it is rapidly converted into dense zirconium hydroxide, which is readily separated by washing. This body is then dissolved in concentrated nitric acid, and the solution is evaporated on a water bath, producing clear gum-like crusts consisting of zirconium nitrate. This substance dissolved in water forms a main constituent of the incandescent body. A patent taken May 20, 1886, by J. Mactear should be mentioned in connection with this subject, as it was obtained especially in relation to the system, and the patentee is one of the directors of the Welsbach Light Company. It claims the application and use, for impregnating hoods for purposes of incandescence, of strontia, baryta, and thoria, separately or in combination, and the mixture of such materials with zirconia, the main object being that when the fabric is destroyed by incineration the earthy particles retain the form of the fabric, and have relatively considerable strength, while the zirconium supplies the incandescing element. In other words it is a process for strengthening the fragile hood.*

It is to be regretted that although nearly a year and a half have elapsed since Professor Auer's arrangement excited scientific interest, but little has been done in practice, and the only available results are those obtained from the laboratory. In Vienna—its birthplace—some public offices, shops, and private dwellings, have adopted it, and in England, where the patents were acquired at the close of 1885, by a syndicate now merged in a large company, two or three places of public resort have been lighted by it, but only so recently as to afford no means of judging whether the inventor's claims will be justified by experience. In London, indeed, the whole of last year appears to have been lost in perfecting details of what was supposed six months before to be an already per ect invention, and for this reason there is no public experience to draw from as to the practicability and permanence of the light. That the inventors and their friends are profoundly convinced of the immense value of the invention is shown by the fact that they have recently launched a two million dollar company for working the process.

The arrangement of the Welsbach lamp may be described in a few words. A hood of fine fabric, such as net, is impregnated with the zirconium solution already referred to, and when dried and shaped symmetrically, is suspended by platinum wires over a Bunsen burner, the whole being preferably inclosed within a glass chimney. When the burner is lighted the combustible portion of the hood is rapidly burnt away, and the water of the solution evaporated, leaving a skeleton of

* Strontium (Sr—87.2) derives its name from Strontian, a village in Argyllshire, where a peculiar mineral, strontium carbonate, or strontianite, was first found. Strontium occurs chiefly as sulphate or celestine ($Sr\,SO_4$), or as carbonate ($Sr\,CO_3$). The metal is obtained by electrolysis.

Strontium monoxide, or caustic strontia ($Sr\,O$) is obtained in the form of a gray-white porous unfusible mass by the ignition of the nitrate. In contact with water it forms strontium hydroxide ($Sr\,OH_2$), with a specific gravity of 3.625, and when strongly heated is reconverted into strontia.—*A Treatise on Chemistry*, by Roscoe and Shorlemmer, page 313.

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MECHANICS.

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electric light ...
For several y...
standards of illu...
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duration of the li...
als (which must i...
5. The const...
trary, a very mar...
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6. The combi...
the ordinary gas...
jectionable and d...
7. The light...
with the use of th...
The foregoing...
upon successful ...
be fulfilled, there...
domestic uses wo...
produced and sol...

M 3	90	1.95	14.1	7.23	White.
	100	2.10	17.0	8.1	
	125	2.30	20.0	8.47	
M 4	90	2.20	18.6	8.1	White.
	100	2.30	18.8	8.2	
	110	2.50	17.7	7.1	
	90	1.85	11.3	6.1	
M 5	100	2.00	14.0	7.0	This burn... adjusted fo... sures abov...
	125	2.25	19.0	8.4	
	175	2.70	22.4	8.3	
	75	2.15	16.8	7.8	
P 5	80	2.22	17.5	7.0	White.
	90	2.40	17.5	7.3	
	100	2.50	17.8	7.12	
	110	2.65	16.5	6.22	
	120	2.80	16.0	5.7	
	75	2.25	16.3	7.2	
P 4	80	2.40	17.0	7.1	Yellow.
	90	2.55	19.5	7.6	
	100	2.75	19.4	7.0	
	110	2.875	19.0	6.6	
	120	3.00	18.0	6.0	

Corroborating, and indeed surpassing them, are the results o... by the city analyst of Glasgow, the difference in efficiency being ...bly due either to increased heating energy of gas, or to a more fa... reading of the photometer.

Auer v. Welsh...
ports from Vienr...
bach, had succeed...
of zirconium oxid...
when submitted ...
and of sufficient s...
English patents b...
made public, are ...
of the same year.
In the first spec...
invention relates...
form of a hood, r...
proportions of the...
described, are giv...
60 per c...
20 "
20 "
or, as an alterna...
50 per c...
50 "
The claim in ...
substantially as h...
other burners, con...
the substances ne...
dated March 13, ...
mixture with oxid...
of the two metals...
or aluminium" is...

Burner.	Pressure on the Gas in Hundredths of an Inch.	Gas per Hour in Cubic Feet.	Illuminating Power in Standard Candles corrected.	Cand... Cubi...
A	60	2.05	18.96	9...
	70	2.20	21.00	9...
	80	2.42	21.90	9...
B	60	1.95	19.02	9...
	70	2.10	20.75	9...
	80	2.30	21.19	9...
C	90	1.85	18.10	9...
	110	2.02	21.6	10...
	130	2.20	22.60	10...

When it is remembered that the English Board of Trade requi... standard Argand burner shall have an efficiency of 3.2 cand... per cubic foot of gas per hour, and that from seven to eight candles ... obtained from the Welsbach hood, during its best period, the ver... economy resulting will be at once evident.

The Welsbach light complies fully with some, but not by any ... with all, of the conditions mentioned above as being necessary f... successful domestic lighting. Existing fittings are disturbed only ... new burners are necessary, and no additional service pipes are re... The light is far better than that given by gas, and is absolutely ... The color is preferable, though it may be mentioned that norma... Welsbach light is intensely, almost ghastly, white. A remarkable

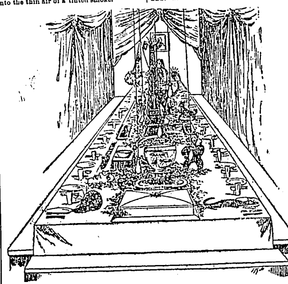
SKULLS GRIN AT A FEAST.

...ight Eyes in Bony Sockets Gleam a Sepulchral Warning.

...ORDS FROM FLESHLESS JAWS.

...en Franklin, in Antique Dress, Repeats Poor Richard's Maxims—Opera Music from Paris Heard—Viands Cooked by Electricity—An Apocalypse Menagerie at a Newark Dinner.

The first annual dinner of the Franklin ...xperimental Club, of Newark, N. J., took ...lace in the laboratory of the Association ...n Bloomfield avenue, just off Broad street, ...ast evening. It was the weirdest affair of ...he kind that was ever given, and a society ...eporter would have been at his wits' end to ...rite it up. There were fish and fowl and ...ruits in plenty, to be sure. But those were only incidentals, strange as it may seem. The *piece de resistance* of the banquet was cooked by electricity before the eyes of the ...hirty-five guests. There were phosphorescent *entrees*, blue light *entremets*, a magical dessert and electrical *hors d'œuvres*. It wasn't precisely a Barmecide feast, for there was enough to eat and drink everywhere. But there were people present whose mouths were watering after a tempting-looking viand just within reach of their hands, and who, when they attempted to take a bite of it, found it shoot up into yellow, green or scarlet flames, bite their fingers with a smarting blaze, or melt away into the thin air of a tinted smoke.



THAT CURIOUS ELECTRIC DINNER TABLE.

The dinner was partly a joke, partly a genuine feast and partly a scientific demonstration. The Franklin Experimental Club is now only in its swaddling clothes, but it is growing fast and is working away in earnest to popularize electric experimentation. The dinner last night was given to celebrate its first birthday, to amuse its guests and its members, and to present some of the results that have been accomplished in the past twelve-month.

William J. Hammer, who was Edison's representative at the Paris Exposition, was the prime spirit in the enterprise, and no one can discredit the fact that the dinner was the most original ever given. Only think of this: it was presided over by Ben Franklin in person, who made a very graceful speech, and welcomed the guests. He sat at the head of the board, his long white hair hanging over his shoulders, dressed in a suit of brown broadcloth, with lace at his neck and wrists—a fashion strangely out of date at presen, t it is true—and he talked in a way that sounded something like Old Richard's almanac and something like the language of the Court of Louis XVI.

THE IMPROVISED DINING-ROOM.

The laboratory had been transformed from its work a day, world appearance as if by magic. In the centre of the room there was a long, narrow table, the ordinary work-bench of the place, covered with snow-white napery and adorned with what looked like luscious fruits, fresh flowers and sparkling glass. Some of the fruit and flowers were real enough, 'twas certain, but what was true and what was artificial it would have taken Solomon to ascertain.

The guests sat down and were served with the first course. There was no chef employed. It was cooked by electricity, and in fact so was everything, down to the coffee which was made over wires. The diners had no sooner got their teeth into samples from a deliciously stewed dish of oysters, when bang! out went the incandescent lights and darkness reigned. Then there appeared out of the shadows a couple of hideous grinning skulls. Their eyes shone fire, their mouths shot forth flames. Their jaws moved with a snapping like a crocodile's, and from their invisible throats there came forth two sepulchral voices in unison:

As ye are now so once were we;
As we are now so ye shall be.

It was a pleasing appetizer. Mr. Hammer had, as if by magic, brought them out of space somehow, and had, by the subtle use of a battery and a phonograph, made eyes gleam where in reality only sockets were and their fleshless jaws move as if alive. Mr. Hammer has a friend who has a deep bass voice which seems to issue from his feet, and he it was who was pressed into service for the manufacture of the phonographic sound. Of course, after the mechanism of the thing was explained every man had a good laugh on his neighbor. But the apparition of the grinning, speaking skulls, one of which in life had been detached from its body by the guillotine, was ghastly in the extreme. It was a sort of reminiscence of the old Egyptian "skeleton at the feast."

The lights were turned up again and another course was introduced. All unsuspecting, the various guests began to enjoy the product cooked by electricity. But with Ben Franklin at the table there was small chance for sybaritic enjoyment of the meal. He sat smiling an oily, benignant smile, when suddenly there issued from his waxen gullet the following sententious maxim:

POOR RICHARD'S WARNING.

"A fat kitchen makes a lean will: if you would know the value of money try and borrow some."

And, all the time the old philosopher sat there smiling, imperturbed. It was a mean trick for the frugal old philosopher of colonial days to play on the degenerate pleasure-loving scion of the present time.

And so the dinner went on. In the midst of it suddenly there burst forth the sound of a delicious voice. It was Mme. Adini's, of the Grand Opera in Paris. She sang a few notes, and then suddenly there merged into hers the deep notes of a rich basso. That was Melchissedec's. Together they were pouring forth the inspiriting music of the "Marseillaise." Next there came the booming of cannon, the thrilling notes of a grand bugle solo, with its echoes against the buildings of Paris, and finally a man's voice again making a graceful little address. You could hear the plaudits of a crowd, the "all hail" of a populace which was crying out as with one voice: "Vive la France!" "Vive la Republique!" "Vive Carnot!"

By the dextrous placing of a phonograph the guests at the strange little dinner in Newark had been transported away across the Atlantic and were listening to the last closing exercises of the Paris Exposition. The man's voice distinctly heard making a speech was M. Eiffel's.

In the place that a sorbet would naturally occupy in an ordinary dinner the lights suddenly went out again and a strange thing happened. Near the middle of the table there had been throughout the dinner a great globe of gold-fishes through which flashed the varied colored lights that had been turned on from time to time. All of a sudden, as if a magician had waved his wand, the globe became illumined with a monochrome. In the globe of glass were seen swimming about the little live fishes of gold or silver, which were as transparent as those tiny affairs that fakirs sell in the streets for the amusement of children. All the anatomy of the shiny fishes was plainly discernible. And they swam and swam about as if nothing more unusual had occurred than was natural with the finny folk. Yet each one of these fishes had inserted down his throat—down into his stomach—a miniature electric-light about the size of a big pea and was sailing about with a thin, hair-like wire in its gullet that was almost invisible to the naked eye. This of course was attached to a dynamo which produced the light that transfigured their little bodies, and the effect that the display produced was wonderful.

WONDERS WITH EVERY COURSE.

So the dinner went on, and with every course, with every other minute, some strange, uncanny thing was done by the magical intervention of electricity. The oysters were stewed by the same mystical force, so were the eggs boiled, so the water for the punch was heated. And then just as the guests were swallowing the last but one oyster on their plates or smacking their lips after the draining of a glass of electric punch something odd and creepy took place. Between whiles once, for instance, the lights went out and there appeared on the table a miniature menagerie, the inmates of which had blazing eyes, mouths spitting forth flames like the animals in the Apocalypse, and all were doing some surprising thing. Every one as he sat down had noticed the stuffed bear, the crocodile, the long-necked heron and other specimens of the kind which adorned the table, but every one looked upon them as mere ornaments and nothing else. Yet in the twinkling of an eye the bear became blue, the heron green, the crocodile pink, and during the illumination a Senator present swore that he saw the crocodile shed tears. But nothing was remarkable at this banquet.

At another time just as the dessert was well entered upon there was a sound like the busting of a bomb, and a big round affair, which had been hanging all the evening above the table in the most innocent manner, was shattered into a hundred pieces. The result was something like the fusillade of confetti during the old-time carnival at Rome. Every man was showered with bon-bons, as if he were caught in a snow storm, and it literally snowed candy. Again the sound of conversation was interrupted by the braying of a big brazen trumpet, which had the crescendo of a fog-horn, and the diners sprang from their seats as one man. That fracas, too, had been caused by a simple-looking affair which had been swinging like a cornucopia of roses above their heads. With the rapidity of a pistol-shot, the big bronze Eiffel Tower, just before Mme. Adini began to sing, blushed every tint of the rainbow, and when the phonograph, reproducing the voices which spoke at the closing of the exhibition, began to pour forth its embowelled words, a tiny cannon, the size of a cigarette, echoed the bruit of the cannon's mouth from the phonograph.

And all the time Benjamin Franklin was sitting quietly before the cloth, not saying much, after he had delivered his speech of welcome. Once in awhile some sententious bit of wisdom, like "Industry pays debts, while despair increaseth them," dropped sepulchrally from his lips. He had not made his presence felt for quite a while when, towards the end of the dinner, darkness prevailed once more and a flash of lightning illuminated the room. Ben Franklin had again called down the lightning from the skies. Over in a corner of the place there had been fixed a kite, which every one had supposed was a part of the decorations. But it had a special purpose, and when the room was darkened this time this weird waxen image, by some incantation of Mr. Hammer, repeated the experiment, famous to every schoolboy, by which electricity was first discovered.

CIGARETTES LIGHTED BY ELECTRICITY.

After that the coffee was brewed on the table by electricity and the cigars and cigarettes were passed from one guest to another along a miniature toy railroad that ran on a track about the table. The latter could only be lighted by electricity, as no matches were provided. During the dinner it was no uncommon thing for a man to pick up a plate and drop it again as if it were a bomb. It had been charged heavily with the same force and was one of the many quiet jokes that were perpetrated during the evening. Just as the banquet was ending all the flowers overhanging the table fell in showers upon the guests below. Tiny bits of iron had been attached to each rose or carnation, which were held in their places by the attraction of a magnet. When the circuit was broken the flowery shower followed. The air was kept cool all the time by steel fans worked by electricity, and among the numerous other odd things that happened was the sudden burst of piano music that broke in upon the banquet. This was produced by a subtle telephonic connection with a piano in the next block, played by a young woman who was notified by a local telegraph when her services were required. Mr. Edison, through the medium of a phonographic cylinder, made some pleasant remarks about Franklin, and through a like medium De Wolf Hopper's robust voice filled the apartment with the topical song "You Can Always Explain It Away." At 11 o'clock sharp the strident voice of Franklin quietly remarked: "Early to bed and early to rise makes a man healthy, wealthy and wise." And so the strange dinner was over.

Among the people who shared in the electric feast were Mayor Haynes, of Newark; Edward Weston, Lieut. F. J. Sprague, Francis R. Upton, James M. Beck, Assistant District-Attorney, of Philadelphia; Theodore Van Wyck, Senator Michael T. Barrett, William Wallace, the electrical pioneer; R. F. Outcault, Dr. T. W. Corwin, Vice-President of the Club; Secretary F. W. Hillard, Prof. George C. Sonn, Superintendent of Public Schools; W. N. Barringer and Lyndon Bryce, Secretary of the Board of Education.

Everything about the dinner had been unusual and so was the manner of recording it. Instead of using pen and ink to take down the speeches and resolutions, the guests and officer's own voices were transmitted on to a cylinder, which was to be put in the archives of the Club. Any time during the next one hundred years, if the minutes are needed for reference, all that a member will have to do will be to turn the handle of a phonographic machine, and though being dead, any person who uttered speech last evening will speak again. As a souvenir of the dinner each guest was presented with a handsome medallion of Ben Franklin.

" Rejoicing in hope ; patient in tribulation ; continuing instant in prayer."—*Romans xii., 12.*

Egerton House, Vaughan Street,
Llandudno, June 8th, 1909.

IN LOVING MEMORY OF

Emma Batchelor

WHO DIED JUNE 5TH. 1909.

Aged 60 Years,

And was this day interred at Llanrhos, near Llandudno.

Eye hath not seen, nor ear heard, neither have entered into the heart of man, the things which God hath prepared for them that love him.—1 Cor. ii., 9.

Egerton House, Vaughan Street,
Llandudno, March [illegible], 1888.

In Loving Memory of

JAMES DREW BATCHELOR.

LATE OF MANCHESTER.

WHO DIED MARCH [illegible]th, 1888.

AGED 72 YEARS.

And was this day interred at Eglwysrhos, near Llandudno.

EFFECT.
A corpse lay frozen stiff with ice;
Stained with gore.
CAUSE.
He failed to heed this strange device,
"Shut the door."
—*Pittsburg Chronicle-Telegraph.*

When we're getting along in years
And more of the world we see,
It almost makes us weep to think
How fresh we used to be!
—*Jessamine (Ky.) Journal.*

Edison's New Laboratory.

A visitor at Orange, N. J., will notice in the beautiful Llewellyn Park, about a quarter of a mile from the main entrance, a palatial residence of Queen Anne style, with porte-cochère, conservatory, and large grounds beautified by the landscape gardener. This is the residence of Edison. Here one would think the great inventor might retire and enjoy in quiet the reward of his genius and of his untiring labors; but those who have followed his career and learned something of his indefatigable perseverance can never believe that he will cease to work while life lasts. Indeed, indications are not wanting that the characteristics of the future will be still greater activity and more thoroughly organized and better directed effort.

Not more than half a mile from Edison's residence are the foundations and rapidly rising walls of five large buildings, which, when completed and furnished, will constitute his laboratory. It will probably be the largest and most complete private laboratory in the world. Orders have been placed for the physical and chemical apparatus with the best makers in America and Europe. The finest machinery for all uses has been ordered, and will soon be in place. No purely historic apparatus or machinery has been purchased. Everything will be on a practical basis. The range of the laboratory will be extremely wide and diversified. Any experiment relating to anything of which we have any knowledge may here be tried speedily and with all possible precision. The laboratory is exclusively for Mr. Edison's own use, and will be wholly applied to perfecting his inventions and putting them in commercial form.

It may here be said that Mr. Edison makes no claims to the title of scientist. He is simply and purely an inventor, and as such is determined to see his inventions embodied in practical form in the shortest possible time after they have been conceived. He will employ a corps of competent men, and will have rough and finished material of all sizes and descriptions.

The main building of the laboratory is 250 feet long, 50 feet wide, and three stories high. It will contain on the lower floor a complete machine shop, provided with lathes of all descriptions and various sizes, from 60 inches down, planers, milling machines, gear cutters, and all varieties of machines required for working iron, steel, and other metals. This shop is driven by a 40 horse power engine, built by Brown, of Fitchburg, Mass. Upon the second floor of the main building there will be a grinding and polishing department, which will include the grinding of all tools, gear cutters, reamers, mills, mandrels, and arbors, lapidary work, lens grinding, etc. Upon this floor there will also be a room devoted to photography, another devoted to drawing, another to machinery and instruments of precision. Here there will be a large dividing engine for circles, another for bars. There will be three experiment rooms, in which apparatus made in other parts of the laboratory will be experimented with and perfected. Upon this floor the power will be distributed by electricity, a motor being placed at each machine. A 100 volt electrical conductor will extend all over the laboratory, and the motors will range from one-tenth horse power to three or four horse power. In each experiment room there will be a table provided with pipes for supplying city gas, fuel gas, compressed air, cold water, hot water, steam, and hydrogen. There will also be here, as elsewhere throughout the entire laboratory, wires for conveying electric currents, varying in electro-motive force as follows: One 3 volt conductor, one 1,200 volt, one 100 volt, and one 8 volt. In addition to the wires for conveying currents to the various parts of the laboratory, there will be portable batteries of various kinds, suited to different work.

The top floor of the main building is devoted mostly to fine apparatus. There will be 31 cases for such apparatus, each 2 feet 4 inches wide and 21 feet long. There will be about $18,000 worth of apparatus of this sort in this department. The apparatus has been ordered from such makers as Elliemann, Hartman & Braulm, Lattimer, Clark & Muirhead, Siemens Bros., Carpentier, Societe Genevoise, and, in fact, from all the principal makers. Among the apparatus there will be a large Ruhmkorff coil, a Dubosc phosphoroscope, a Foucault photometer and heliostat, and photometric apparatus of every variety; spectroscopes, and Sir William Thomson's absolute electrometer and quadrant electrometer; a telescope having an Alvan Clark objective and provided with a Young spectroscope, the telescope being mounted equatorially by Fauth; a spectrometer costing $1,200, a micrometer costing $200, a Fauth chronograph. Upon the upper floor there will also be a room for projection, 50×40 feet and 16 feet high. A lantern is being made which will utilize the light of a 5,000 candle arc lamp. Upon this floor there will also be a pump room for lamp experiments, a glass blower's room, and a room for jeweler's work. In the line of mechanics, the laboratory will be able to produce any kind of machine varying in size from that of a locomotive to that of a watch. The main building will contain a large scientific library.

In an annex to the main building will be placed three Babcock boilers, 75 horse power each. In this room will be placed a 14½×15 Armington & Sims high speed engine, one 12×13 Armington & Sims high speed engine, and four dynamos driven by these engines. The dynamos during the day will be employed in testing incandescent lamps and in other work of the laboratory, and during the night they will be employed in furnishing a current to about 1,000 incandescent lamps in Llewellyn Park and 300 lamps in the laboratory.

In addition to the main building and its annex, there are four buildings, each 25 feet wide, 100 feet long, and 16 feet high. In one of these buildings, which is devoted to galvanometers, the use of iron has been carefully avoided, the nails being copper and brass, the tubes lead and copper, and the hinges, locks, window fasteners, etc., all being of non-magnetic material. In the galvanometer building there will be seven piers of solid stone entirely detached from the walls of the building, each being provided with a slate top, having a covering of vulcanized hard rubber 1 inch thick. There will also be two large piers on a level with the floor, 15 feet long and 8 feet wide. The apparatus used in this room will be devoted to all kinds of electrical and magnetic testing.

The second of the smaller buildings will contain a complete chemical laboratory, a balance and spectroscopic room, an analytical room, and a room for general experimental work. One-half of the third building will be used as a carpenter's shop, cabinet making and pattern shop. The balance of this building will be used for the storage of chemicals.

The fourth building will be devoted to metallurgy. It will contain a five stamp mill, a Blake crusher, a 6,000 ampere dynamo, and furnaces of various kinds. It will be supplied with fuel gas from a 40 barrel gasoline gas-producing machine.

$6,262 worth of pure chemicals have been purchased, a quantity of every known substance on the face of the globe has been ordered; all kinds of ores, metals, fabrics, gums, resins, and samples of every imaginable material.

The following is a small fragment of one of Mr. Edison's lists of materials, the entire list filling several volumes:

2 lb. horsetail hair.
2 " hogs' bristles.
5 " cows' hair.
2 " rabbit hair used by felt hat makers.
1 " common goat hair.
10 " best sheep's wool.
1 oz. mink hair.
2 " human hair.
1 " porcupine quills, assorted.
1 " camel's hair, fine.
1 " " " coarse.
1 mink skin, hair on.
1 coon " " "
1 deer " " "
1 " " " off.
1 sable " " on.
1 fox " " "
1 cat " " "
1 " " " off.
1 dog " " on.
1 " " " off.
1 seal " " on.
1 " " " off.
1 bear " " on.
2 squirrel skins, hair on.
1 rabbit skin, hair on.
1 " " " off.
4 sheep skins, tanned.
2 rawhides (bull's).
2 hides, French kip.
2 " thick sole leather.
1 doz. chamois skins.
1 walrus hide, tanned.
2 common leather hides.
2 hides, patent leather (best).
½ doz. ostrich feathers.
100 goose quills.
100 assorted hen feathers.
½ oz. swan down.
1 peacock tail.
5 lb. hops.
1 bu. barley.
1 " oats.
1 " wheat.
1 " rye.
1 " buckwheat.
1 bu. beans (common).
1 " peas (common).
50 lb. bran.
50 " oatmeal.
1 bu. corn (shelled).
1 bbl. flour (wheat).
1 " flour (rye).
1 " buckwheat flour.
1 bag corn meal.
50 lb. rice.
5 " assorted ivory.
1 doz. walrus tusks.
1 " bulls' horns.
1 deer horn.
2 oz. sharks' teeth.
½ " small tortoise shells.
½ " common turtle shells.
1 large turtle shell.
50 lb. horse hoof.
50 " cow hoof.
6 sp. white sewing silk, each size, from largest to finest.
2 lb. unspun white silk, reeled on bobbin.
2 bobbins of silk from cocoon.
6 sp. each of finest to coarsest cotton sewing thread.
2 lb. worsted skeins, assorted sizes (white).
1 " shoemaker's wax.
1 " " cord.
5 balls each of finest to coarsest cotton twine.
6 " each of finest to coarsest linen.
25 lb. marlin.
50 fish lines, assorted.
50 lb. clothes line.
2 " best book ink (printer's).
10 " common printer's ink.
1 " each of printer's ink (every color).
Metals, moulding sand, lampblack, pumice stone, rotten stone, oils, soaps, mica, sugar, glycerine, glucose, dextrin, cork in all shapes, etc., etc.

This is a heterogeneous list, but since a complete list will comprise all known substances, these things must necessarily be included. Mr. Edison proposes to have on hand, at the time of the opening of the laboratory for work, materials of all kinds now known, in sufficient quantity to last for five years' experimentation. This enterprise has been a dream of Mr. Edison's since his youth. The realization of it is now rendered possible by the great success of his inventions.

The present buildings were started on the 5th of July, in the present year, and will be finished and ready for occupancy November 1. The cost of the buildings and their contents will be $180,000. The working force of the laboratory will comprise forty skilled men, aside from Mr. Edison and his first assistant, Mr. Batchelor.

The method of developing an invention will be as follows: Rough sketches will be submitted to model makers, who will secure from the vast supplies of material blanks for the necessary parts, or possibly completed pieces for the apparatus, and as many work men as can be employed to advantage will be at once detailed for the work, and thus the working model will be brought out in a very short time. Any improvements necessary are then made, working drawings are prepared, the necessary patterns and castings made, and the complete, full sized machine or apparatus is at once constructed, tested, and if it is found to fulfill the expectations of the inventor, it is removed to be duplicated elsewhere. Inventions of sufficient magnitude to warrant the venture will be launched as the bases of separate industries. The Edison Machine Works at Schenectady, N. Y., employing 800 men, and the Edison Lamp Works at Harrison, N. J., employing 400 men and turning out 1,000,000 lamps per annum, are examples of what may be expected to follow the completion of the new laboratory.

ELECTRICAL REVIEW

Inventor Tesla Replies to Dr. Louis Duncan, Explaining His Alternating Current Motor.

TO THE EDITOR OF ELECTRICAL REVIEW:

I find in your issue of last week a note of Mr. Duncan referring to my system of alternate current motors.

As I see that Dr. Duncan has not as yet been made acquainted with the real character of my invention, I cannot consider his article in the light of a serious criticism and would think it unnecessary to respond; but desiring to express my consideration for him and the importance which I attach to his opinion, I will point out here briefly the characteristic features of my invention, inasmuch as they have a direct bearing on the article above referred to.

The principle of action of my motor will be well understood from the following:

By passing alternate currents in proper manner through independent energizing circuits in the motor, a progressive shifting or rotation of the poles of the same is effected. This shifting is more or less continuous according to the construction of the motor and the character and relative phase of the currents employed, and I have indicated the theoretical conditions which should exist in order to secure the most perfect action.

If a laminated ring be wound with four coils, and the same be connected in proper order to two independent circuits of an alternate current generator adapted for this purpose, the passage of the currents through the coils produces theoretically a rotation of the poles of the ring, and in actual practice in a series of experiments, I have demonstrated the complete analogy between such a ring and a revolving magnet. From the application of this principle to the operation of motors, two forms of motor of a character widely differing have resulted, one designed for constant and the other for variable load. The misunderstanding of Dr. Duncan is due to the fact that the prominent features of each of these two forms have not been specifically stated. In illustration of a representative of the second class, I refer to Fig. 1, on page 1 of ELECTRICAL REVIEW of May 12th. In this instance, the armature of the motor is provided with two coils at right angles. As it may be believed that a symmetrical arrangement of the coils with respect to the poles is required, I will assume that the armature is provided with a great number of diametrically wound coils or conductors closed upon themselves, and forming as many independent circuits. Let it now be supposed that the ring is permanently magnetized so as to show two poles (N and S) at two points diametrically opposite, and that it is rotated by mechanical power. The armature being stationary, the rotation of the ring magnet will set up currents in the closed armature coils. These currents will be most intense at or near the points of the greatest density of the force, and they will produce poles upon the armature core at right angles to those of the ring. Of course there will be other elements entering into action which will tend to modify this, but for the present they may be left unconsidered. As far as the location of the poles upon the armature core is concerned, the currents generated in the armature coils will always act in the same manner, and will maintain continuously the poles of the core in the same position, with respect to those of the ring in any position of the latter, and independently of the speed. From the attraction between the core and the ring, a continuous rotary effort, constant in all positions, will result, the same as in a continuous current motor with a great number of armature coils. If the armature be allowed to turn, it will revolve in the direction of rotation of the ring magnet, the induced current diminishing as the speed increases, until upon the armature reaching very nearly the speed of the magnet, just enough current will flow through the coils to keep up the rotation. If, instead of rotating the ring by mechanical power the poles of the same are shifted by the action of the alternate currents in the two circuits, the same results are obtained.

Now compare this system with a continuous current system. In the latter we have alternate currents in the generator and motor coils, and intervening devices for commutating the currents, which on the motor besides effect automatically a progressive shifting or rotation of the poles of the armature; here we have the same elements and identically the same operation, but without the commutating devices. In view of the fact that these devices are entirely unessential to the operation, such alternate current system will—at least in many respects—show a complete similarity with a continuous current system, and the motor will act precisely like a continuous current motor. If the load is augmented the speed is diminished and the rotary effort correspondingly increased, as more current is made to pass through the energizing circuits; load being taken off the speed increases and the current, and consequently the effort, is lessened. The effort, of course, is greatest when the armature is in the state of rest.

But since the analogy is complete, how about the maximum efficiency and current passing through the circuits when the motor is running without any load, one will naturally inquire? It must be remembered that we have to deal with alternate currents. In this form the motor simply represents a transformer in which currents are induced by a dynamic action instead of by reversals, and as it might be expected the efficiency will be maximum at full load. As regards the current, there will be—at least under proper conditions—as wide a variation in its strength as in a transformer, and by observing proper rules, it may be reduced to any desired quantity. Moreover, the current passing through the motor when running free, is no measure for the energy absorbed since the instruments indicate only the numerical sum of the direct and induced electro-motive forces and currents instead of showing their difference.

Regarding the other class of these motors, designed for constant speed, the objections of Dr. Duncan are, in a measure, applicable to certain constructions, but it should be considered that such motors are not expected to run without any, or with a very light load, and, if so, they do not, when properly constructed, present in this respect any more disadvantage than transformers under similar conditions. Besides, both features, rotary effort and tendency to constant speed, may be combined in a motor, and any desired preponderance may be given to either one, and in this manner a motor may be obtained possessing any desired character and capable of satisfying any possible demand in practice.

In conclusion, I will remark, with all respect to Dr. Duncan, that the advantages claimed for my system are not mere assumptions, but results actually obtained, and that for this purpose experiments have been conducted through a long period, and with an assiduity such as only a deep interest in the invention could inspire; nevertheless, although my motor is the fruit of long labor and careful investigation, I do not wish to claim any other merit beyond that of having invented, and I leave it to men more competent than myself to determine the true laws of the principle and the best mode of its application. What the result of these investigations will be the future will tell; but whatever they may be and to whatever this principle may lead, I shall be sufficiently recompensed if later it will be admitted that I have contributed a share, however small, to the advancement of science.

NIKOLA TESLA.

New York, May 26.

2419

to Mr. Blaine?

Mr. Depew laughed heartily. "Why, that was one of my stories. It was stolen outright. I wouldn't have minded the theft, but they didn't get it straight. I got it off at one of the Yale Alumni Association meetings. You know we chaff one another pretty hard there sometimes. At one meeting a member read a paper attacking me rather savagely. In reply I told him that as president of the organization I was prevented from answering him as I should like to, but instead would tell a story. It was this: A friend of mine accepted a free ticket to an amateur performance. The piece was wretched and the acting was something awful. The first act was greeted with hisses, but my friend sat silent and undemonstrative. The second act made the audience fairly howl. My friend, however, maintained his composure. Finally, an excited auditor leaned over and asked him: 'Stranger, do you like this play?' My friend said 'No.' 'Then,' yelled the other, 'why in thunder don't you howl with the rest of us?' 'Well, you see,' rejoined my friend, 'I came in here on a free pass. It would not be proper for me to say anything, but if the third act is as bad as the first and second I'll go out, buy a ticket and come back and just raise hell.'"

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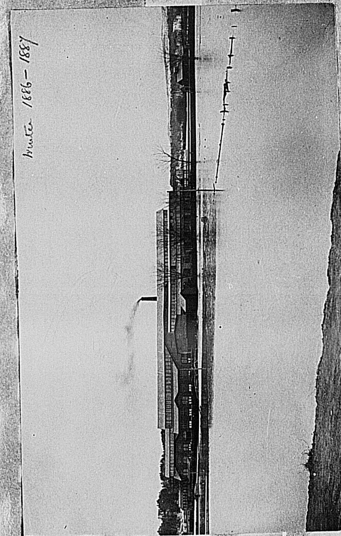

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2441

WHAT MR. EDISON'S PHONOGRAPH WILL DO.

TO THE EDITOR OF THE MANCHESTER CITY NEWS.

Sir,—I can endorse all the remarks which you quote from an American paper as regards the above wonderful machine. About five years ago a partner of Mr. Edison's was over here (who, by the way, is a native of this city) and had one of those machines with him, and he made it a present to his brother, who is a friend of mine. Shortly after he got it I invited him to my house and asked him to bring it with him, which he did, and I also invited a number of friends. It is needless to say that we were all simply astounded. We sang into it and talked into it, and made every conceivable noise into it that we could possibly think of, and, to our astonishment, everything we did was afterwards repeated, and, singular to say, in the same tone of voice, which anyone could distinguish.

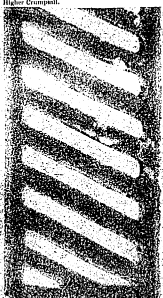
At that time Edison and his partner called it "a toy," but his partner made the remark when here that "some day, when we have a little more time on our hands, we shall develope it and astound the world with what it can do." From the remarks you make, I see they have made some alterations, whereas the one I saw was turned by a handle, and the one you refer to is worked by a pedal, evidently showing that they are now developing it. No doubt we shall all hear more of it by and bye.

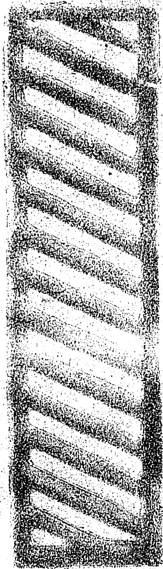
It may interest many of your readers to know that a "Manchester lad" is a partner with Mr. Edison, having been associated with him from the beginning of his career, and shared all the toil and anxiety of all his experiments, and is now with Mr. Edison reaping the reward of their labours. His father was highly esteemed and respected by all who knew him, and was for many years a resident in Cheetham Hill, but is now enjoying himself in his old age at Llandudno, having retired several years ago.

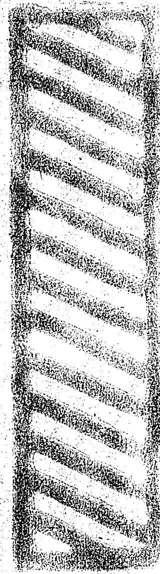
N. M'CLINTON.

Higher Crumpsall.

2440







Y, MARCH 2, 1890.—TWE

FRANK M'GOWAN MISSING.

World

Unaccountable Absence of One of Mr. Edison's Valued Assistants.

Frank McGowan, one of Inventor Edison's trusted lieutenants, is missing. It was only a short time ago that he returned from South America after a two years' search for a species of bamboo, out of which Mr. Edison wanted to make the charcoal loops for his incandescent lamps. McGowan's search was so successful that Mr. Edison rewarded him with a block of stock valued at $2,000 in addition to his salary and expenses. His health, however, had suffered, and he spent last summer at Bath Beach recuperating.

On the afternoon of Wednesday, Jan. 15, at about 3 o'clock, Mr. McGowan left the Edison laboratory, where he was employed as superintendent of the construction of some new buildings, and came to New York. He told Thomas Maguire, a fellow employee with whom he boarded at 167 Alden street, Orange, that he would return that evening. He did not even take his overcoat. Mr. Maguire says that McGowan is known to have kept an engagement that he had with Mr. Charles Batchelor of this city for that evening; that he left Mr. Batchelor's house between 10 and 11 o'clock, and that he took lunch on the next day with one or two of his fellow employees. The last one of his friends to have seen him is Ernest Rau, a cigar manufacturer and dealer at 181 Clinton place. McGowan, who is an old friend of Rau's, called at his place of business on the afternoon of Thursday, Jan. 16. He had two checks, one for $100 and one for $18 or $19. He wanted Mr. Rau to cash the smaller one for him, and he did so. He also made arrangements with Mr. Rau to procure for him two wigs for a friend of his in South America who had two baldheaded children. McGowan was to have called for them on the following Saturday. Mr. Rau got the wigs, but they were not called for. McGowan, on leaving Mr. Rau took a Christopher street car, as he said, to return to Orange. That was the last seen or heard of him, and that was six weeks ago.

Mr. Rau thinks McGowan has been murdered for his money, of which he is supposed to have had about $1,800 with him, besides the $100 check. Capt. M. F. McGowan, the missing man's uncle, an old seafaring man, who lives at 109 Charlton street, thinks his nephew fell a victim to a gang of toughs somewhere about the wharves, who had seen him display money. "He never would have gone off in this way without letting me know," said the old Captain. "Not long ago he said to me: 'Uncle, I will never go to South America without I see you.' Three years ago, when he went to South America, he made everything over to me in case anything should happen to him, and left with me his gold watch. I am the only near relative he has living, and he would never leave me like this. I am satisfied that he has met with foul play."

Mr. Thomas Maguire, with whom McGowan boarded, talked very differently. "McGowan was the last man in the world that any stranger would care to tackle," he said. "Though short, he was powerfully built, and was a good deal of an athlete. He was always on his guard, too, and the man who should try to get away with him would undertake a big contract. He was, moreover, inclined to be impulsive, and would often say: 'Well, I will be off for South America some day before anybody knows it.'"

Mr. Maguire thinks he has gone to the United States of Colombia, where he has mining interests. Mr. Edison is at Charlotte, N. C., for a month's recreation. McGowan had not been drinking when he left Rau's store in Clinton place. He never took anything more than a glass of beer, his friends say. He is described as a man of strong common sense, whom it would be very hard to lead into a trap. He was 41 years old, unmarried, 5 feet 5 inches tall, and strongly built. His dark hair was rather thin, and he wore a heavy black moustache. His eyes were brown, his features small and regular, and his hands and feet unusually small for a man. There were several scars on the back of his head, which were made while he served before the mast.

There is a bit of romance about his life, which may possibly account for his disappearance. He contracted a fever while in South America, and a native girl nursed him through it successfully. He has often spoken of this girl to his friends since his return, and has always pictured her as the fairest of her sex.

A STRANGE DISAPPEARANCE

DID McGOWAN MEET FOUL PLAY?

Mch 2 1890

HE HAS BEEN MISSING FOR SIX WEEKS AND HIS RELATIVES THINK THAT HE IS DEAD.

Relatives and friends of Frank McGowan, who disappeared mysteriously on January 15, have given up hope of seeing him alive again. They think he met with foul play because they cannot explain his disappearance on any other theory.

McGowan was forty-one years old and had travelled extensively. He was a sailor before he went into the employ of Thomas A. Edison about ten years ago. The inventor sent agents to different parts of the globe to search for a peculiar species of bamboo, the fibre of which was wanted for use in the incandescent electric light. McGowan had been in South America and he offered to go there and search for the particular bamboo which Mr. Edison was in need of. Mr. Edison sent him on the perilous journey three years ago, and McGowan found what other agents had sought for in vain. The specimens which he sent from South America were satisfactory, but Mr. Edison had discovered a cheaper substitute for the bamboo fibre. In his travels McGowan suffered many hardships and came near dying from fever. He returned to this city early last summer with shattered health. Mr. Edison paid him $2,000 and gave him some stock in his company. He also paid his board at Bath Beach, where McGowan rested until September. McGowan apparently regained his health, and he went to work for Mr. Edison again at Orange, N. J.

On January 15, McGowan came to this city with about $1,800 in checks and bank notes in his pockets. In the afternoon he went to see his friend Ernest Rau, the cigar dealer at No. 131 Clinton Place. He showed to Rau a receipted bill for two wigs which he had purchased from J. Bernadat, of No. 18 East Fourteenth-st., and said he had ordered the wigs to be sent to Rau's store. They were for two children of a friend in South America, he said, and he would see about sending them on his return to the city on the following Saturday. The wigs have been kept by Rau since they were sent to him. McGowan drew from his pocket two checks, one for $100 and the other for $20, and at his request Rau cashed the smaller check. "I will get you to cash the other check when I come back on Saturday," McGowan said, as he put it back into his pocket.

At 4:30 p. m. McGowan got on a car to go to the ferry, as he was intending to return to Orange. Rau saw him get on the car. Since then McGowan has not been seen by any acquaintance. As he had been intending to follow Mr. Edison to South Carolina, his disappearance did not cause any alarm for a week. Then Mr. Batchellor, of the Edison Company, started a search which has been prosecuted with vigor in New-York, Brooklyn and New-Jersey. Hospitals, hotels and morgues have been visited by Pinkerton's detectives, and it has been said that Inspector Byrnes was interested in the search, although McGowan's name is not included in the official police list of missing persons.

Captain M. F. McGowan, of No. 100 Charlton-st., the uncle and nearest living relative of the missing man, said last evening, that he believed Frank had been robbed and murdered in Jersey City. Captain McGowan's son John, who saw much of Frank, said that the missing man was temperate, and never was known to lose his reason, even when he was sick.

McGowan had talked of going back to South America to operate gold and silver mines there, but he would not have undertaken such a journey without informing his friends.

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NPS #1341

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2457

NEW YORK.

THURSDAY, MAY 2, 1889.

Frank McGowan's Journey Through South American Wilds.

One of the chief problems that Edison has had to contend with in perfecting the electric light was the discovery of a suitable material for the loop. He made a long series of costly experiments before he hit upon his carbon filament, which are the little black thread-like loops which are to be seen inside the little air-tight globes.

Edison has been satisfied that somewhere in the world there grew a plant or reed or bamboo from whose fibre the perfect filament could be obtained.

He and his company have spent many thousand dollars in the effort to discover this plant. They have sent experts to the uttermost parts of the world who up to this time have failed to discover this fibre. But a day or two ago there returned from that mysterious land, that is, the heart of the South American continent, a young man who there discovered that for which so much money, energy and thought have been expended.

The discovery of the present form of incandescent light by Mr. Edison began with a series of experiments on various substances. It had long been known that the metal platinum gave out a peculiar glow when an electric current of the proper strength was passed through it.

Starting from this basis, Mr. Edison endeavored to produce the same effect with charcoal of one form or other substituted for platinum. At first the resistence was so high in proportion to the amount of light developed that it seemed as if no progress could be made in this direction. At last, however, the idea of removing the air from contact with the carbon loop occurred to Mr. Edison, and from that moment the problem of an incandescent light was solved.

Having now got a working light, Mr. Edison's next was to find the most suitable substance out of which to make the carbon loop which gives out the light. He set to work on this in characteristic fashion. The earth was ransacked for rare trees and shrubs out of which the most suitable charcoal might be made. For some time boxwood was found to give the best results. Then bamboo was found to be much superior to boxwood. It evidently narrowed itself then into a question of which kind of bamboo. What is desirable is a wood which naturally splits into thin strips, with the substance of these strips as homogeneous as possible throughout the whole length of each one of them. In this way the little incandescent loop wears itself naturally out without breaking.

In a less perfect piece of wood the strip breaks early in its lighting career and the lamp becomes useless until a fresh bamboo charcoal strip is substituted.

This discovery is of vast importance and represents a value which can hardly be estimated to the electric light companies.

Besides making this discovery this young man had experienced adventures of the most remarkable and startling nature, which are herewith presented.

Mr. Frank McGowan, one of the bright young men associated with Prof. Edison in his laboratory work at Orange, has just returned from South America after an absence of a year and a half. His mission was to procure for Mr. Edison a certain kind of bamboo, which has proved to be one of the very best materials the wizard has as yet discovered for the transmission of electricity. Although the voyage was extremely hazardous and beset with many dangers, Mr. McGowan was determined to make it, even if it cost him his life. He accomplished his end, but at the expense of his health and perhaps future happiness, for he has returned with his constitution greatly shattered. His travels carried him through the unbroken forests of South America, where he encountered not only wild beasts, snakes, reptiles, crocodiles and predatory bands of Indians, but exposed himself to the wasting ravages of low fevers. He forded rivers, waded swamps, penetrated unknown mountain fastnesses and scaled the lofty Cordilleras. He ascended the Amazon 2,300 miles and traversed the continent from ocean to ocean.

NO MEAT FOR 116 DAYS.

He was obliged to go ninety-eight days without removing his clothes, and 116 days without eating meat, and during all of this time he was dependent upon the services of friendly savages, with whom he could not converse or even make his wants known except by the sign language.

Mr. Edison is exceedingly pleased with the result of the trip. McGowan proved himself to be an intrepid traveller, and has returned with a large and varied stock of fibrous material, which has been laid aside for experimental work. In fact, so very much pleased was the Wizard that he ordered McGowan to recreate at Delmonico's till he had fully recovered from the trying strain put upon him by the trip.

"Get the best the Frenchman can give you," Mr. Edison said, "and send the bills in to me. Don't come to Orange till you have fully recovered."

McGowan is modest in his tastes, and he thought the mortuary repose of Greenwich, Conn., with the splendid opportunities it afforded for sailing and fishing on the Sound, would about answer his purpose, and accordingly it was there that he betook himself. In referring to the episodes in his trip he is exceedingly modest, but relates them with so much earnestness and sincerity that he commands the attention of the listener at once. "You want to hear about my trip, eh!" he ejaculated when an EVENING SUN man met him. "Well, it was a long one, and I fear it would sound too much like a half-dime novel to enlist your sympathy. You know I have been gone a year and a half from home, and during that time I have not been idle. Let me see—it was Sept. 10, 1887, when I left New York. My destination was Para, at the mouth of the Amazon. When I arrived there I felt lost, as every one spoke Spanish except me. How did I get along? Well, I learned Spanish, too There was nothing else to do. Upon arriving at Para I lost no time in setting out for the interior, and immediately engaged passage on a steamship running up the Amazon. The steamships run as far as Iquitos, a distance of 2,200 miles. These Amazonian steamships are queer rigged affairs. The decks are all open, and the passengers sleep out in the open air at night in hammocks, with hardly anything for a covering except a mosquito net, which is very essential.

A VAMPIRE SUCKING HER LIFE BLOOD.

"Comparatively little occurred on my journey up the river to break the monotony of the steamship's daily routine. At Santarem, a small village 450 miles above Para, I visited an American family named Pitt, whom I found in great agitation. Their only daughter, a beautiful girl about 20 years old, was believed to be on the verge of consumption. She formerly had a plump and well-rounded figure, but had recently wasted away till there was hardly anything save a shadow of her left. Apparently she was without dis[illegible] and the family were greatly distressed [illegible] know what was the matter. It was decided to set a watch upon her, and what did they discover one night but a huge vampire bat engaged in slowly sucking her life blood while she innocently lay sleeping. The fellow had first operated between her toes, leaving such a small puncture as to escape notice, but had afterward changed the base of his operations to her knee, where he was at work when discovered. You can safely wager that no time was lost in sending the dastard to the happy hunting ground. The girl speedily recovered her health, and is now as rugged and stout as ever. Having completed my visit with the Pitts I resumed my journey up the Amazon by steamship. The Brazilians are exceedingly courteous people, but lack enterprise. In the latter respect the Portuguese outdo them, and are by all odds the wealthy class. They have some queer ideas, though.

"For instance, they care nothing for their dress or appearance, but take unlimited pride in owning a handsome hammock. Every man going aboard these Amazonian steamships was obliged to furnish himself with a hammock. A hammock cost all the way from $5 to $60, and the Portuguese invariably had the most expensive. They seemed to size up a man's position in society according to the value of his hammock, very much as we do here in regard to a man's dress.

"Going up the Amazon you meet with nothing but yellow water and dense forests. Fish abound in the river and are remarkable principally for their variety. They are caught in large numbers and furnish a staple in the food supply.

SHOOTING ALLIGATORS.

"The banks of the river are lined with alligators, and the passengers on board our steamship amused themselves during the day with their Winchesters in picking the slimy denizons of the Amazon off while they were enjoying a morning's sunning. Fifty-two alligators were shot one morning from the steamship's deck. The poor things would jump fifteen feet into the air when struck, and would then flounder about in the water, lashing it into foam for

...stated, to de...

a radius of many feet. It was cruel sport, but it varied the monotony, and helped pass away many weary hours.

"It is an old saying among the inhabitants of Brazil that when the rainy season begins the boa constrictors and smaller serpents, together with the lions and tigers and all the other animals, desert the islands in the river and swim to the mainland, where they take refuge in the depths of the forests. No man can penetrate the Brazilian forests alone. A foreigner could not go five miles without being devoured by wild beasts or poisoned by serpents, and even the natives do not venture any distance unless it is in parties.

SHOWERS OF ARROWS.

"Brazilians in years past in going up the river were accustomed to give vent to their deviltry by firing grape shot into the Indians, who were usually assembled on the banks in large numbers. Now, matters are very much reversed, and the Indians having been taught to retaliate, amuse themselves by making a target of the Brazilian gunboats and literally deluging them with showers of arrows. You can imagine what kind of a stampede ensues among the passengers when suddenly a cloud of arrows descends upon deck without the slightest warning.

"The Indians shoot these arrows with such terrific force as to send them through the steamship's hull. I shall never forget my own experience. It was like peril dropping out of a clear sky. We were all lazily engaged one sunny afternoon in dragging out an existence on the steamship's deck in smoking and in otherwise diverting ourselves, when suddenly from out of the forests came a volley of arrows. They rained upon the deck by the hundreds, but fortunately not a soul was injured. We all managed to get down into the hold, and not a mother's son dared to show his head for hours afterward.

"Probably you won't believe it, but some of those arrows penetrated the woodwork and were found in the steamship's hull. You certainly would not find much difficulty in believing it if you could once see their bows. They are at least eight feet long, and at the middle are as thick as my wrist; I could not bend one of them. The strings are made from the bark of trees. The arrows are about five feet in length, and are invariably tipped with poison.

ALL FOREIGNERS UNDER ARREST.

"On Oct. 17 I arrived in Manaos, a thriving town 1,000 miles up the Amazon. Steamships from England, Portugal, and the United States make Manaos their port. It is the headquarters of the rubber trade, and on that account is a great commercial centre. When I reached there the people were greatly excited over a murder which had just been committed. The victim was a native estimated to be worth \$5,000,000. The excitement was running very high, and all the foreigners had been placed under arrest, not because there was any evidence to implicate them in the crime, but merely on general principles. My arrival was untimely, and I would undoubtedly have been arrested had not suspicion been directed toward the private secretary of the murdered man. He was arrested and the foreigners were liberated, and thus I escaped imprisonment.

"The only evidence upon which they arrested the secretary was the mere fact that on the night of the murder he was seen in a black Prince Albert suit of clothes, which is something unusual in that country for a person to wear, as white linen is the prevailing toggery. In this case the arrest was all right, as the prisoner afterward made a confession of the crime. While at Manaos I became acquainted with two enterprising young mechanics, Giddy and Wright.

"They had occasion during my stay to send a gang of men up one of the tributaries of the Amazon to repair a small steam launch.

HEADS VERY MUCH SWELLED.

"The mechanics were unable to return the first night, but they did not fail to get back the next day in double-quick time, and such a sight as they presented I shall never forget. Their heads were swollen to twice the normal size and were covered with lumps as large as hen's eggs, while their noses looked like a full-blown cauliflower. It was the result of the mosquitoes getting in their fine art.

They told me that the only way in which they could worry through the night with any degree of comfort was by sinking their canoes in about three feet of water and then by sitting in them, submerged in water up to their noses. By that means they succeeded in protecting their bodies and limbs and a large proportion of their face from the ravages of these bothersome pests. The small portion of their head which they were necessarily obliged to expose above water in order to breathe was covered by mosquito netting, but it was of no earthly protection, as the South American mosquito will bite through anything short of a stone wall or the broad side of a frame house. Jersey mosquitoes are nowhere alongside of them, and I speak advisedly, as I have had experience with both.

THE PESTILENT PEUM.

"The small insects that infest the forest, however, are fully as troublesome and their bites are, in most cases, much more poisonous. I had my own sweet time with them. One of the most troublesome kind of these small tartars is the peum, a small, red, animal, invisible to the naked eye. He burrows underneath the skin and causes a heap of itching. But there is another pest who eclipses the peum for pure, unadulterated cussedness and never fails to play havoc wherever he chances to alight. He is very appropriately called a jigger.

LAYS EGGS UNDER YOUR FLESH.

"His method of procedure is to dig into the flesh and then lay eggs. Usually he selects that portion of a man's anatomy located around the toes, and when he has planted himself, to his entire satisfaction, the foot commences to swell. In due time an abscess is formed, and serious trouble is bound to ensue unless the jigger is taken in hand at once and eliminated. This is done only with a sharp knife, and that, too, in the hands of a skilled person. The wound is lanced and the jigger is picked out by the aid of a needle with the assistance of a powerful microscope. The sore is then healed with a coating of cigar ashes or wax taken from the human ear. Why, I have seen negroes with their toes entirely rotted off, all because of

their neglect to remove the jiggers. They paid no heed to them whatever. While at Manaos I had a very good opportunity of observing the laborers gather rubber, which they brought from the rivers Purus and Madeira, tributaries to the Amazon. The labor is performed by Peons, who are natives, and a more hardy or robust set of men never trod on God's footstool. They are employed in gangs of 500, and perform the roughest kind of work for a mere pittance. One thing is certain, and that is, the rubber supply will never become exhausted as the trees are not cut down. It is prohibited by law. English capital, backed by Brazilian enterprise, is pushing public improvements in Manaos, and the place is destined to be a magnificent city. At the present time the people are engaged in constructing water works on a gigantic scale, and are intending to carry water into the city from the mountains at a distance of eight miles. From Para to Manaos the fare on the steamship had been good, but from Manaos to Iquitos it was wretched. It was due to the fact that the first portion of the trip was under the management of the steamship companies, while from Manaos to Iquitos, the captains of the steamships supplied the passengers with their rations. Of course the captains are anxious to make a dollar now and then, it matters little to them whether it is honestly or not, and they are accustomed to do it in a large degree by scrimping the passengers' bill of fare.

"There are 120 steamships on the Amazon and they are constantly changing their board of directors for the reason that the captains do so much smuggling as to greatly curtail their running expenses. Some of the captains make \$10,000 a year. They make no bones in concealing the fact, and one of them in conversation with me boasted of the fact as though it was an accomplishment.

AMERICANS IN DISTRESS.

"I arrived at Iquitos, Peru, on Dec. 16, 1887. The city is on the Amazon, 2,300 miles from its mouth, and was started by the Peruvian Government as headquarters for repairing steamships. I found a great many Americans there, and the wails of distress and stories of woe and poverty those poor fellows poured into my ears were truly heart-rending.

"Several years ago the Government of Peru advertised for competent mechanics, to whom they offered a three years' contract and liberal wages. Mechanics flocked to Iquitos in droves from all parts of the civilized world, the majority coming from the United States. The Government officials treated them very kindly at first, and their wages were paid very promptly for the first year and a half, after which time payments ceased altogether.

"The small foreign colony, however, continued to live on in innocent bliss and perfect confidence in the Peruvian Government to make good their promises. In the meantime many died from low fever, and the few that remain are struggling on in the hopes that the money due them will eventually be paid. They are too poor to pay their passages home again, and many, I am sorry to say, are separated from their families, whom they left at home, hoping at some future time, when prosperity smiled upon them, to bring them to Iquitos. I fear those men will never be reunited to their families.

THE LOST ART OF REDUCING HEADS.

"At a small town below Iquitos a man was exhibiting the head of an Indian which had been reduced to one-half its natural size. He brought it aboard the steamship when we touched at the place, and I think that I never saw before a more disgusting and horrible sight. The head of the Indian was as true as life, the same as it was the day it was severed from the body of this wild man of the forest. The expression of anguish and pain was still vividly depicted upon his face.

"The man held the head up to the gaze of all by the long, black, shaggy hair. The lips were pouting, and showed the teeth exposed, while the eyeballs were glazed and set rigidly, as in death. The head was worth \$2,000. I could not tell you how they had reduced its size, as that is now considered a lost art. The work was all done without even removing a bone, and the flesh was preserved as well and naturally as it was possible for human agency to perfect it. The natives cannot perform such marvels nowadays. As I say, that kind of work is a lost art, and it is just as well that it is so.

AFRAID TO SLEEP AT NIGHT.

"From Iquitos I struck out on foot across the country, accompanied by three Inca Indians, who served as my body guard, servants and guides. I started on a bee line for the River Napo, as by so doing I saved many weary days of canoeing in the small streams, which run in circuitous directions. Of course I was encumbered with a large amount of baggage, the most troublesome article being a tin box in which I carried 300 South American silver dollars. The box weighed about twenty-five pounds, and for my own protection I carried it under my arm. Every time those coins jingled I noticed that the Indians exchanged significant glances, and in consequence I was in mortal dread to go to sleep at nights for fear those Indians would take it into their heads to take my scalp as a souvenir of the good times which the contents of my tin box promised them.

"The journey from Iquitos to the River Napo across country took three days, but it lay through ravines, swamps, rivers, mountains and virgin forests. It was one of the hardest roads I ever travelled and it nearly cost me my life. It all came about through my Indian guides travelling on ahead of me. Our water supply had given out and I had become overcome with thirst.

A FORERUNNER OF DEATH.

"The faintness came on, and I thought I would drop from exhaustion. The Indians were at least half a mile in advance of me. I came to a pool of stagnant water, and though it was reeking with filth I didn't hesitate to drink. I then laid myself down at the base of a large tree. Night was coming on, and I could hear the cries of a bird mimicking human groans of distress so true to life that one might readily believe a man were dying in some secluded spot near him. It was the first time I had ever heard the cry of this bird, but I recognized its notes at once from the accounts I had read of it when a boy in Buffon's Natural History. It was always regarded as a forerunner of death. I had now almost given myself up for lost.

AWAKENED BY A FIERCE GROWL.

"I sank back in a stupor, when I was suddenly awakened by a fierce growl. Dancing about me I saw one of the Indians, who pulled and tugged at me roughly, and pointing into the fo[illegible] said in Spanish, 'Big tiger.'

"The Indian assisted me to my feet and led me up the mountain side, and that night we reached the Napo River. The following morning we started out in our canoes, and during the day we poled up the stream many miles. At night we camped on the shore, sleeping on the wet banks.

WASHED OFF THE BANKS WHILE SLEEPING.

"Twelve times during our journey the river rose so high that our party was washed off the banks while sleeping on this account. Four times I was obliged to go without any sleep at all because of predatory Indian bands hovering about our camp. On such occasions we spent the night in poling up the river. We could hear the hoots and howls of the Indians as they carried on their midnight orgies. I had fresh in my mind a murder that had been committed five months previous by one of these marauding bands of savages, when they ruthlessly killed a trader with his entire family.

"Our supply of provisions now began to fail and we were obliged to subsist on turtles' eggs. We frequently found as many as 150 of these eggs in a single nest.

MEDITATED KILLING INDIANS.

"The Aquarico River was the next stream we navigated. Here the Indians stole the greater part of our provisions excepting rice, upon which we had to live for the next ten days. At this time I became discouraged, and it was the first time in my life I ever meditated murder. I had almost made up my mind to kill the thieving Indians, for I had about resolved that it was their lives or mine.

A WEALTHY AMERICAN.

"One of the most agreeable events of the trip was my meeting with George Edwards, an American, who lives two miles above the town of Napo. He has amassed great wealth through dealing with the natives, purchasing gold dust, &c. At Archidona, a small town on the river last navigated, I became acquainted with Padre Tobias, the chief priest of that vicinity, to whom I carried a letter of introduction from the Vice Consul of Ecquador. He treated me most hospitably and made me feel as much at home as it was possible for a native to do. He also supplied me with a camping outfit and gave me permission to take Indians into the interior.

"Nothing is done in that part of the country without consent of the parish priests, who hold full sway, but who govern justly and wisely. They levy a tax of one-fifth of all productions of the year for the support of the local government.

A WEEK'S SPREE ON "CHICHU."

"Before starting out from Archidona the Indians felt it necessary to go upon a spree, as it is their custom before starting out on any journey. Usually it is only a three days' spree, but in this case their orgies lasted an entire week. They drank a concoction called chichu, made from yuca and plantain. They indulged in the wildest sort of orgies and were incapacitated for work for the entire journey on account of their libations.

"My objective point was Quito. This necessitated my going through one of the most unsettled and uncivilized parts of South America. The roads were rough and dangerous, and laid principally through the mountains."

"We made the trip, however, without any events worthy of particular notice, arriving at Quito eighteen months after we started from the mouth of the Amazon. When I arrived at Quito I found the people in the midst of a holiday celebration. They were amusing themselves by throwing over ripe eggs and decayed vegetables at each other.

A TARGET FOR OVER RIPE EGGS.

"The moment I appeared I was made a target for all these missiles, and when I reached my hotel I presented a sorry looking spectacle indeed. I was covered from head to foot with dirt and filth, and was a laughing stock for everyone.

Quito is very much behind the times, as compared with other cities of South America. I made my stay there very brief."

The remainder of my journeyings led through the valley of Quito, a lovely spot, unsurpassed for fertility.

"In going through the forest my guides had great sport shooting monkeys, which were present in large numbers. They disturbed our slumbers at night with their unearthly howling.

"At Cachabi my Indian guides turned back and I was obliged to fall back upon negroes to escort me through the country. Like the Indians they felt it incumbent upon themselves to indulge in another wild drunk.

"They played upon all manner of barbarous instruments, the principal one being made of bamboo, similar to a caliope. They played upon drums, and indulged in some very high kicking.

365 FEAST DAYS A YEAR.

"They had more feast days in that part of the country than you can imagine; in fact, there are 365 feast days in the year. The negroes wanted to continue their spree for a week, but I objected, and we compromised the matter by allowing them three days.

"The chief negro said to me the day after we started, 'Senor, this is a feast day; we can't travel.'

"'What is that to me,' I replied. 'I want to get ahead.'

"'Oh, no, that won't do,' he said; 'we would go to hell if we proceeded any further.'

"Again I was obliged to compromise on half time. All through the trip I was subjected to these annoyances.

RIVER SNAKES SIX INCHES IN DIAMETER.

"In going down the River Santiago we encountered river snakes fifteen feet long and six inches in diameter. They were loathsome reptiles. It was now the rainy season, and we could not sleep at night, for every two hours or so we had to bail out the canoes.

"The temperature was 100 to 102, and our clothing fairly steamed from moisture. We encountered millions of sand flies, which got into our eyes, ears and hair.

"The river is full of fish, and you can see them jump out of the water in all directions. Frequently in the morning we found fish in the bottom of the canoe which jumped in during the night.

"After varied experiences with serpents and wild animals we finally reached Buena Ventura, on the sea coast, where I embarked on a Pacific mail steamship from Panama, and thence home. It was a most eventful trip, I think you will agree."

2458

THE MANCHESTER W[EEKLY]

HEARTH AND HOME.

BY A LADY CONTRIBUTOR.

The interest which is taken in the furnishing question is shown by the columns devoted to the subject in ladies' newspapers. Housewives in a state of puzzlement as to how to arrange their rooms write for information, and receive a flood of suggestions as to wallpapers, the judicious disposal of furniture, and other interesting details. Some of the correspondents appear to have only the very faintest idea of how to contrive a pretty room, and their letters must try the patience of the consulting decorator. The suggestions of the latter, who is generally a highly ingenious person, are sometimes extraordinary; but allowance must be made for the unmanageable material with which the writer has to deal. Generally the room about which advice is asked is already furnished, and its owner seeks by the addition of new drapery or a rearrangement of chairs and tables, to give what brightness may be possible to commonplace and even ugly fittings. So the decoration is but patchwork and consists of making the best of a bad job. Now the decoration of a room, if it is to be right, must be right from the beginning, and if the wall paper and painting are not in good taste no after arrangement of sofas and drapery will make it look well. Even a hundred Japanese fans will not save it. What an important part these simple ornaments play in our decorations. We should hardly know how to get on without them, and as for the decorators by correspondence, fans form the first and last articles of their creed. I must confess to disliking the too lavish use of fans or screens, however pretty they may be, and I particularly dislike the way in which ingenious housekeepers set up trophies of them, evidently thinking that they are a good substitute for old china or oil paintings. Certainly they are better than the baskets of wax fruit and flowers whose place they have taken. A fan that is well painted makes a pretty piece of colour when hung on the wall, and as fans are very useful to screen the fire from one's face there is no reason why one or two should not be hung about or stand on the mantelpiece ready to hand. But the way in which fans are commonly arranged, shows that they are not in the least meant for use; they are intended to be purely ornamental. In a drawing room the other day I counted over 30 screens and fans; if I had had time to complete the counting I think the number would have turned out to be nearly 40. Some were in pots, as if they had been flowers; some hung on the wall; some nodded from bookcases; some stood or lay on the floor. Fans tumbled out of the fire-grate and peeped round the corners of brackets; I almost expected to find that the floors were carpeted, and the doors panelled with them. But enough of fans, which are, to use the common saying, "All very well in their place," a remark which I have observed always irritates the person to whom it is addressed, whatever may be the subject in hand.

were the words "[illegible]" and "[illegible]" spoken to the sensitive diaphragm before fair progress in this direction was made. Every word both said and sung on Tuesday was reproduced with startling accuracy, including some very happy imitations of the drawl and stutter of the English swell by Colonel Gouraud. Some interesting musical performances followed, and the visitors heard some remarkable reproductions. Most of these were heard through the tubes applied to the ears. A duet between a cornet and a pianoforte player, recorded in New York three months ago, was among the most noteworthy of these for the clearness with which the combined effects of the two instruments were brought out, though it was stated that this single performance had in this fashion actually been repeated one thousand times. One practical application of the phonograph to which Colonel Gouraud called the attention of his guests was the fact that it has become his custom to dictate his letters to the phonograph at his leisure; and his amanuensis afterwards sets the instrument in motion, and writes from its repetition. A shorthand clerk is thus no longer necessary; and the cylinder which has been addressed remains an enduring witness of the words which have been spoken to it, and a test of the accuracy of the copyist.

2459

The Edison Electric Illuminating Co. of New York.

1889 Oct 29 89

General Office, 432 5th ave.

To the Public:

Inasmuch as the subject of electric lighting is now agitating the public mind, and many believe that there is no safe method of employing electricity for supplying light and power, the Edison Electric Illuminating Company of New York would respectfully invite all parties interested to examine their Station, located Nos. 47 to 51 West 26th street, between the hours of 2 and 5 o'clock P. M., for the next ten days and verify for themselves the force of the current. The greatest shock that can be taken from the Edison System is 115 volts on a side, and even if both sides of an Edison three-wire system (which is the system generally used by it) are handled, it is only equal to 230 volts of continuous current, which will not in any way injure a person and is nothing like so great as a shock from an ordinary magnetic battery as now used for general medical purposes. Nobody has ever been killed or injured by the Edison incandescent system, which, being a continuous current of low tension, is incapable of producing death or even injury.

It takes from 1,000 to 1,500 volts of continuous current to kill, and such pressure is never employed by the Edison Company, nor is it possible to produce it from the apparatus used by it. Moreover, the Edison system as used in New York and other large cities has always been carried entirely under ground.

There will be in attendance at the Station between the hours named an employee who will demonstrate the harmlessness of the system, and it is hoped that all parties interested will take advantage of this offer.

THE EDISON ELECTRIC ILLUMINATING CO. OF NEW YORK.

By order of the Board of Directors.

2460

EDISON'S BIRTHDAY.

THE WIZARD OF MENLO PARK SURPRISED BY HIS ASSOCIATES.

Feb 11. 1889

When the Great Electrician Walked Into His Laboratory This Morning He Found the Furnishings Had All Been Changed and in Their Place Were Solid Oak Tables, Elegant Leather Covered Chairs, Soft Smyrna Rugs, and the Most Delicate and Complete Gold Silver Phonograph the Happy Wizard Had Ever Seen.

"Did you see what the boys gave to me for a birthday present? There are no flies on that."

Those were the first words uttered by Thomas A. Edison as he stepped out of the library in his invention mill at Orange, N. J., this morning. It was about 10 o'clock, and three-quarters of an hour previous the Wizard had come from his house to the laboratory and had walked into the library. There was not a soul in the big room when he entered it, but there were plenty of evidences that somebody had been there.

For when Mr. Edison left his library and went to his home on Saturday afternoon it was a rather sparely furnished place. There was a desk there and three or four tables, a half a dozen chairs, a clock face without hands or works, and one or two old rugs on the floor. In the big fireplace were two little brass andirons.

This morning when all unsuspectingly he walked into the room he found it completely transformed. It was completely and handsomely furnished. There were seven beautifully carved solid oak tables placed where they were most needed. There were eighteen oak and leather armchairs, with T. A. E. in a monogram carved on the backs of each one.

There were twelve oak and leather revolving office chairs with the same monogram carved on each. Th're was placed near the Wizard's desk a big soft leather reclining chair, which could be turned into a most comfortable bed with a simple turn of the wrist, and in front of the big fireplace were too great easy leather and oak armchairs, so full of springs and fashioned so cunningly that one felt lazy and luxurious just to look at them.

In the big fireplace itself was an enormous gas-log, whose flames leaped merrily up the wide chimney and sent a genial heat out into the room. The gas-log in turn rested on a pair of great wrought iron andirons which were burnt and twisted in the latest æsthetic style.

High on the wall over the burning logs was the old clock face, which had never had any hands to show the time o' day. But the hands were there this morning and were pointing at the right time to a second, for behind the dial was an electric clock regulated at Washington, D. C. On the polished floor, which on Saturday had looked so bare with its scanty coverings of three old rugs, were thirteen thick, soft Smyrna rugs.

The air was heavy with the perfume of flowers, which were in every nook and corner of the room, and great palms and tropical plants stood here and there and added to the beauty of the room.

But the most beautiful of all the beautiful things in the library, and the object which probably first caught the great inventor's eye, was a perfect gold and silver working phonograph, the finest and most exquisitely finished talking machine ever made.

It stood in front of a window opposite the wide doorway, and rested on a finely polished mahogany table, arranged with many drawers to hold several hundred phonograms.

Mr. Edison had never seen a phonograph like that in his life. It was fashioned entirely of silver and gold and steel, and glistened within its fine convex glass cover like a great jewel.

On top of the inventor's cylinder desk was a silver cigar case, richly engraved and covered with raised figures representing a hunting scene.

And resting on the front of the desk was this explanation of the marvellous change which had taken place in the library:

> The Surrounding Outfit of Laboratory Conveniences are Presented, on his 42d Birthday, to
> MR. THOMAS A. EDISON
> by All the Present and a Few of the Past Workers in his Laboratory.
> *Orange, Feb. 11.*

The card was framed in flowers.

For three-quarters of an hour was Mr. Edison left alone and undisturbed in the library. The donors of the superb birthday present knew the man and his nature, and so they left him alone there. They knew that he would rather have it so.

What the Wizard did in that room while the big gold hands of the new electric clock moved three-fourths of the way around the dial no one will ever know.

But his fellow workers and helpers are good guessers, and they pictured their chief going around from one piece of furniture to another, now inspecting the carving on a table, now sinking luxuriously into one of the great easy chairs, again standing by the fireplace watching the flames dancing merrily behind the fantastic fire logs.

They thought how he would first note the clock hands on what had always been only the shell of a timepiece, and how he would compare them with his watch to find them exact to the second.

They imagined him treading over the deep soft rugs as he approached the gold and silver phonograph, and noted its beauties.

But then this was only guesswork after all. What they really knew was that when at last he came out his face was radiant with smiles and happiness, and when he approached one of the workmen and said, "There are no flies on that," they knew that his heart was too full of emotion for a more formal acknowledgment.

Besides there never was any formality in Edison's laboratory, and there never will be.

A quarter of an hour later Mr. Edison re-entered the library, and then Mr. Tate, his private secretary; Mr. Ott, the superintendent of the laboratory, and several others, together with an EVENING SUN reporter, went in, too.

The Wizard walked straight to the silver and gold phonograph and stood there quite silent for awhile. The others stood around in a little group.

"There," said Mr. Edison at last as he turned to the EVENING SUN man, "is the first perfect phonograph ever made."

The reporter thought that Mr. Edison was referring to the gold and silver and exquisite finish of the instrument, but he was quickly disillusioned. The inventor put his finger on one of the screws which were attached to the transmitter and the receiver.

"There is something that I was at work over for three months," he said. "It regulates automatically the pressure of the needles on the cylinder. Formerly the needles had to be adjusted at the proper distance by means of a thumbscrew, and it required delicate manipulation.

"With this new attachment any one can work the phonograph and, as I said, it is now perfect—complete for the first time."

Then with a smile he added: "I only completed my work on that last Saturday afternoon, and do you know that the boys actually got together after I went home yesterday and made two of the new automatic arrangements in silver for this phonograph. I thought they seemed mighty anxious to have me get away."

Then Mr. Wasserman, who knows almost as much about phonographs as the Wizard himself, came up and offered Mr. Edison a cigar from the new silver cigar case.

"The boys have been making me a present this morning," was all he said to the reporter, but his face told a great deal more than any mere words could.

For the past three weeks the hundred or more workers in the laboratory have been arranging to surprise Mr. Edison on his birthday.

A committee appointed by them carefully selected the articles or had them made to order, and everything was kept a profound secret from the Wizard.

He hadn't the remotest idea that they were going to give him anything until he walked into the library this morning.

The work was all done yesterday and it was late in the evening before all the arrangements were completed.

The flowers were added to the room early this morning.

Perhaps the most useful of all the new pieces of furniture is the big reclining chair close to Mr. Edison's desk. He often works for days and nights together without taking needed rest.

Maybe the inviting chair so near him, stretching out its arms in mute entreaty, may woo him from his labors at such times and so bring rest to his overtaxed and very precious brain.

2461

EDISON'S WORKS IN PARIS.

HIS PLANS FOR THE EXPOSITION.

1889.

EXTENSIVE PREPARATIONS FOR THE DISPLAY OF ELECTRICAL INVENTIONS.

For several days Thomas A. Edison has been busily engaged in sending off articles for his exhibit at the Paris Exposition. Nearly one-third of the entire floor space allowed to the United States has been given to him, and his preparations are on an extensive scale. The exhibit of phonographs will include a large number of instruments, each of the latest type, with Mr. Edison's latest improved automatic tension regulator. A corps of assistants will be in attendance, speaking nearly all the languages of the civilized world. All the various kinds of instruments will be shown, from the original phonograph now in the South Kensington Museum, London, down to the very latest improved type.

The telegraph department will contain models of all the machines and patents that Mr. Edison has worked out and all the improvements he has effected. In the telephone division there will be a chronological arrangement of all the devices from the original Edison instrument popularly known as the "Blake transmitter," down to his latest improved motorgraph, or loud-speaking telephone. There will be a complete working system set up showing the Edison carbon telephones and the motorgraphs working in juxtaposition. In electric lighting there will be a complete three-wire municipal system extending over all the exhibit, complete with motor, dynamos, central station, and indicating and regulating apparatus, as perfect as if for a large city. The principal feature of the whole exhibit, however, will be an enormous model of an incandescent lamp forty feet high, the globe being composed of no less than 20,000 incandescent lamp bulbs, and the luminous filament within being indicated by a loop of red colored incandescent lamps. The effect when the light is flashed into these thousands of bulbs will be wonderfully brilliant, and it will illuminate the entire main building.

Around the base of this novel lamp will be a series of panels illustrative of the various stages of the manufacture of incandescent lamps, and on either side will be the French and American flags worked out in colored incandescent globes. One will be inscribed "Paris," and the other "Edison." Among other novelties will be a huge dynamo capable of running 2,000 lamps, much the largest dynamo that has ever been constructed. An interesting feature will be a series of charts, 100 in number, showing the growth and development of all Mr. Edison's inventions, from the first crude idea, through all the successive stages, to the complete and perfected instrument. There will be a number of frames showing the filaments in their natural condition, and after being carbonized, with samples, arranged in chronological order, of all the substances that have been experimented with in this direction.

An interesting map of the first electric central station and district in this city will also be exhibited, with a tabular statement showing the growth of the business from a net loss of $4,457 in 1883 to a net profit of $116,235 in 1888, and this despite the reduction of gas to $1 25 per 1,000 feet, while the equivalent cost of electric light is $2 25.

A novel effect will be produced by a large allegorical picture now being painted in the laboratory entitled "Menlo Park, the birthplace of the incandescent lamp." It will show the original workshops and laboratory of the wizard at Menlo Park in the gray twilight of a wintry day, with a flood of radiance streaming from the windows. In the foreground and running around to the right is shown the original first electric railroad ever built. Rising out of the central building is a vast ghostly incandescent bulb whose radiating beams illuminate a series of bordering designs showing the principal buildings of the world now lighted by the Edison system, among them the Palace of the Mikado of Japan, the Houses of Parliament, both in London and in Cape Town, South Africa, and the palace of the Emperor of Siam.

Three large shipments of several hundred cases have already been made and the remainder will be packed and shipped within a week or two. The Exposition will open on May 4, when Mr. Edison expects to have the entire exhibit in working order.

2462

2463

The young man who attends to Mr. Edison's interests at the Paris Exhibition has been getting into trouble. His name is William J. Hammer. The day President Carnot went through the American department he examined the phonograph. Judge of his astonishment at hearing a statement come from it in the voice of Mr. Hammer to the effect that a few hours ago the representative of a Paris newspaper (which he named) came to him and offered for a money consideration to give a good notice of the President's examination of the phonograph. If he were not paid he should ignore the matter. President Carnot let the matter pass in silence, but not so the newspaper men, and particularly the newspaper whose representative had been impugned. To make matters worse Mr. Hammer came out in a card in an English paper in which he amplified his statement to cover the entire French press, which he said would not mention an exhibit without getting paid for it. Then there was a great row, which is sure to react on Edison. The American inventor will arrive in Paris next Monday, probably, and unless this matter is patched up some way it will surely interfere with arrangements made to give him a series of receptions. The Parisian journalists are going to call on Mr. Edison and ask him to compel Hammer to retract his charge, or he must be put to the expense of proving it. Hammer is an American who has been with Edison some years. He came over here a few years ago to put up some electric lights, and Edison had so much confidence in him that he put him in charge of the exhibit at the Paris Exhibition. Mr. Edison says that he will not have time to visit England. He expects to be home again in a month. If he did come to England now there is no one of any prominence in London to do him honor, but the manufacturers and scientists in the great manufacturing towns of the north all wanted to entertain him and appointed deputations to receive him.

2464

WHAT A SOUND LOOKS LIKE.

—about 1889.

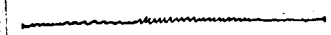
A Peep at the Cylinder of One of Edison's Phonographs.

So many queer things have been done by science in recent years that the public mind is prepared for almost anything—men flying about in the air, people getting their dinner out of the end of a wire and sleep done away with as a waste of time. These dreams have not as yet been realized, but recent discovery has enabled us to see a sound. Through the phonograph, looking down the throat of the machine, you can see a laugh, a cry, a whistle, a strain of music, the ring of a bell, the bark of a dog, thunder and the whistle of a boat on the North River. There it is all recorded on a sheet of wax in a series of little dents or holes made by the point of a needle, and without the use of a powerful magnifying glass you cannot distinguish any difference between these sounds as recorded by the phonograph. Nobody, not even a scientist, would have thought such a machine possible fifteen years ago, and that is why it was discovered by accident and not as the result of a long series of logical scientific deductions, and after it was discovered and perfected science has stepped in and furnished the explanation of its phenomena.

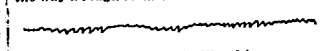
Mr. Edison was one day experimenting with a telephone and, noticing the regular beats of the thin iron diaphragm in harmony with the sounds of words, he wondered whether these could not be recorded. To the diaphragm, which performs the same function in the telephone as the drum does in the ear, he fixed a little arm with a needle point in its end, and when this was set going by some sound it marked its progress on a sheet of tinfoil or wax which passed constantly before it. When the sound ceased and the wax or tinfoil again passed under the needle, setting it and the diaphragm in motion, the process was reversed and the original sounds reproduced.

This explains the mechanical principle of the machine, but does not enlighten anybody as to the nature of a sound and why it should make a series of dots rather than a long undulating scratch on the wax. Here comes in the theory of sound waves, upon which the telephone is founded. According to this theory a sound of any kind—from the gentle breathing of a babe to the report of a canon—is nothing more nor less than an agitation of the air which sets a lot of little air waves in motion, just as a pebble thrown into a sheet of still water creates successive ring waves which widen till they reach the shore. The sound waves are like the waves in the ocean and can undergo but two changes, in being larger or smaller, or far apart or close together, and out of these simple elements is made the infinite variety of sound known to life, so delicate is the mechanism of the ear in detecting their variations. Many people think that the phonograph writes shorthand, probably because that is called phonography and is a system of sound-writing. Shorthand, however, is not true phonography, as it does not write all sounds, but only some sounds, and is really a system of making rapid pictures of the dozen or more elemental letters which form the skeletons of all words. The phonograph, on the other hand, can take anything.

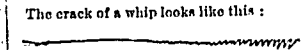
It catches some words better than others. The most difficult are the words containing the letter R, because that letter makes more sound waves than any other and generally more sound waves than all the other letters. All of the vowels make fewer sound waves than the consonants. Curiously enough, loud noises do not disturb the air and make so many waves as some quieter ones, the only difference being that they are stronger waves, a difference of quality rather than of quantity. A sound having a certain number and kind of waves or atmospheric disturbances agitates the diaphraghm of the phonograph, and this little plate is so delicate that it catches every one of them. When the machine is turned back and it is set in motion from the other side by the needle dropping into the holes it has already made the same motion of the diaphragm takes place, and it in turn creates sound waves exactly similar to the original ones, and which strike the ear in the same way. If you put your ear to a drum in a room where there is any noise you will get the same reproduction of a sound. So closely do the sound waves run together that three or four words are recorded upon one inch of surface of the wax cylinder, and it takes a very strong magnifying glass to make them out. Here, for instance, are the words, "THE WORLD," as they look at a side view of the dips of the needle, very much magnified:



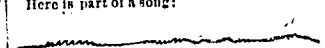
The R, with its vowel sound, occupies most of this phrase, forming the backbone, so to speak, of the whole. The "w" is formed by less than a fifth of the same number of sound waves and the "ld" by about the same number. Here is the way a laugh looks:



The crack of a whip looks like this:



Here is part of a song:



Nearly all of these look very much alike, and even with a magnifying glass one would not believe there was so very much difference if the phonograph did not prove it by reproducing the sounds. The music of a band can be heard in the machine, and each instrument may be detected when all are playing, and yet the needle never crosses its course, but makes a steady forward mark.

2465

MR. EDISON AT HOME UNSPOILED BY GLORY.

His Friends in a Yacht Greet Him Down the Bay with Cheers and Music.

NO TITLES, BUT LOTS OF HONORS.

Herald Oct 7 1889.

Much Gratified at the Attentions He Received, and Enthusiastic About the Paris Exposition.

Thomas Alva Edison was given a most hearty welcome back to his native land yesterday morning. He and his wife arrived from Havre on the steamer La Champagne, which anchored at Quarantine at about six o'clock, but it seemed earlier, for the sky was heavily overcast.

His friends and all his employés had chartered a steam yacht, and with a band aboard were waiting to greet him. Cheer after cheer was given, handkerchiefs were waved and hats were thrown up as those on board the yacht caught sight of the familiar figure of Mr. Edison on the big steamer's deck. Mrs. Edison was by his side.

Some one shouted, "Three cheers and a tiger for 'Count' Edison!" The response could not have been heartier.

As the cheers subsided Mr. Edison and his wife were both seen to be laughing heartily, and this caused much astonishment until he explained to his friends that the story that King Humbert of Italy had made him a "Count" was a hoax. His friends would not have it so, however, and their persistency made Mr. Edison very merry indeed. They declared that if he had not been made a Count he ought to have been made a Duke at least.

Among those who boarded the steamer to shake hands with the great inventor were J. C. Henderson, S. Levor, President Herrick, of the Produce Exchange; W. S. Perry and Samuel Insull.

HIS HEAD NOT SWELLED.

Mr. Insull produced a tape measure, and laughingly proposed to see if the honors, triumphs and hero worship Mr. Edison had received while hobnobbing with titled personages and great men in Europe had increased the girth of his intellectual temple any. Citizen Edison waved him away with majestic scorn, and declared that he came back wearing the same head he had on when he left.

When the steamer reached the foot of Morton street Mr. Edison and his wife boarded the yacht with their baggage and were conveyed to the Erie depot, on the Jersey side, where, after many adieus, they caught the 9:40 train and proceeded to their beautiful home at Llewellyn Park.

I saw Mr. Edison last evening in his luxurious library. He said he could not tell how the mistake that he had been made a Count was made, but supposed that some French reporter, having been told that he had received a personal letter of commendation from both King Humbert and Queen Marguerite for his phonograph, which Chevalier Cappello had exhibited before them, had misunderstood it that he had been made a Count.

AMERICANS MUST HUSTLE.

"I come back decorated with the red ribbon of the Legion of Honor of France, though," said Mr. Edison. "I was made Commander, the highest title they confer on a foreigner. I have attended more dinners since I left these shores than in my whole previous existence. I haven't had time to think hardly since I landed in Europe. My mind has been in a constant whirl.

"The Paris Exposition is simply bewildering! It is grand! Immense! If the Americans hope to surpass it they will have to get to work and never loiter. By the way, how is our Columbus centennial affair progressing? Do you suppose they are really going to hold it here? They don't seem to be raising money very fast. It's a pity that our laws prevent raising money by the lottery system as the French did. There is no doubt that the exposition will be a success if the managers only get about it fast enough. I will fill every inch of space they are willing to give me, and there are hundreds of those who have exhibits at the Paris Exposition who will do the same. The only thing I objected to in the Paris Exposition was that they had their machinery scattered too much. There were sixty-five miles of aisles in it, and a man does not like to travel so far to see machinery."

DINNERS IN HIS HONOR.

Mr. Edison said he was dined and wined so much that he had to open a book to keep track of his engagements. The municipality of Paris gave him a banquet; so did the Society of Electrical Scientists, the Society of Civil Engineers, the Society of Telegraph and Electric Light Companies and the Society of Telephones. The *Figaro* gave him a grand dinner, at which nearly all the theatrical artists and *littérateurs* of France were in attendance. He also attended the fiftieth anniversary dinner of Daguerre, the discoverer of photography.

Every sort of electrical device was exhibited, he said, at the Exposition, but there was really nothing that he could say was new to this country. He had twenty-five phonographs talking, playing and singing constantly. They fairly set the French people wild with enthusiasm. Monet Sully, the French tragedian, was greatly pleased with the phonographs, and whenever he came around always insisted on delivering soliloquies from "Hamlet" with different intonations in order to hear them repeated.

A NEW INVENTION.

"I did not receive any valuable suggestions that I know of in electricity over there," said he. "I am studying on a device for a telephone, so that you can see the man you are talking to. I am almost sure I can make it a scientific success, but I doubt if it will ever be a commercial one. Anything that is not a commercial success, of course, I won't bother with. The scientific men abroad were greatly surprised that I was not more of a scientist, in the higher sense of the phrase. They could not understand that I am between the scientific man and the public.

"At Heidelberg the German association of advanced scientists gave me a dinner, at which were twelve hundred guests. The Grand Duke of Baden was there, with all his guards, and he delivered an address through the phonograph in German. It brought down the house. Every word of it was delivered in such clear tones that it could be heard out of doors. The people go to bed in that town at ten o'clock, but that night we were making things hum at three."

Professor Hertz, of Baden Baden, Mr. Edison said, was the deepest electrical scientist he had encountered in his travels. He thought that from experiments the Professor was making he was on a fair road to discover just what electricity is.

ON A SORE SUBJECT.

Speaking of the decision of Justice Bradley at Pittsburg Saturday in the great "fibrous carbon" fight, in his favor, in the case of the Consolidated Electric Light Company against the McKeesport Light Company, he said:—

"When I went to Pittsburg and saw what an intelligent old man Justice Bradley was I went to Europe in perfect security. Westinghouse used to be a pretty solid fellow, but he has lately taken to shystering. The Sawyer-Man patent was rammed through the Patent Office by a company organized in New York for the purpose of speculation. Westinghouse simply grabbed fifty-four of my patents and started into business, saying that he could sell his manufactures cheaper because he did not have to pay out money experimenting. I have one hundred and fifty suits against Westinghouse and there must be a settlement soon. The Supreme Court, I am confident, will affirm Justice Bradley's decision. To my mind, it is simply referring the matter from Bradley to Bradley.

"Electric lighting in England and Berlin," Mr. Edison added, "had taken a great boom when I was there. All the foreign cities are ahead of New York. At Deptford, in Germany, I went to see the great ten thousand horse power dynamo in operation. The Grand Opera and all other theatres in Paris are lighted by electricity and no gas is allowed in them."

NOT SPOILED BY HONORS. 1889. 2466

Inventor Edison Says He Didn't Get the "Big Head" While Abroad.

Thomas A. Edison, the famous electrician, arrived yesterday by the French steamship La Champagne from his eight weeks' visit to Europe. He brings back with him the highest honors France and Italy can confer upon an American citizen.

"I went over to see the Exposition," said Mr. Edison last night to a WORLD reporter at his home in Llewellyn Park, N. J. "It was a big show. Couldn't begin to see all of it. Acre on acre of things to look at. Of course what I wanted to see most was the machinery and the electrical exhibits. It would take a man weeks just to cover the ground in those two departments."

"What were your impressions of the electrical exhibits?"

"I saw very little that was new. There doesn't seem to have been very much progress made in electricity since the time of the Electrical Exhibition several years ago. One of the best things there was an electrical loom, invented by a Frenchman. I had twenty-five phonographs there, and 30,000 people heard them every day. They were all free. It was the first time the phonograph had been seen in Europe, with the exception of the exhibition before the Academy of Sciences. We had them talking in a dozen languages.

"The showing made by the United States was very poor. Even the little South American republics beat us all hollow. I had one-fifth of the American space in Machinery Hall with my things alone.

"The Eiffel tower is a wonderful thing. I was given a dinner by the French Society of Civil Engineers on the first landing. M. Eiffel was there, too. After we were done we drank our coffee in his private room, on top of the highest landing, to which the public is not admitted. Seventy-five of us did not fill the room. Eiffel has a piano there. Gounod, the composer of "Faust," played and sang, and he did it splendidly, too, despite his more than eighty years."

"You were tendered many dinners while abroad?"

"Dinners! Well, I should say so. It was dinners, dinners, dinners, all the time. I got to be worse than Chauncey Depew. They didn't get me to make any speeches, though. Once I got Depew to make a speech for me, and I got Reid, our Minister there, three or four times. I could never get used to so many big dinners.

At noon I would sit down to what they call a *déjeuner*. That would last until 3 o'clock and a few hours later would come a big dinner. It was terrible. I looked down from the Eiffel Tower on the biggest dinner I ever saw, given to the Mayors of France by the municipality of Paris. I saw 8,000 people eating at one time. I ate one American dinner while abroad given by "Buffalo Bill." Depew, Reid, John Hoey and lots of other Americans were invited. We had mince pie, Boston baked beans and peanuts. John Hoey had brought over some watermelons, which we ate. Before I went to London I got a telegram from the Lord Mayor that he would give me a dinner at the Mansion House, but I couldn't make it in time. But I did have lunch with him there."

"What cities did you visit besides Paris?"

"Went to Cologne, Berlin, Metz, Heidelberg, Brussels and London. At Heidelberg I met a great many of the scientific men of Germany, men that I had heard of for years but had never seen. A monster meeting was held, over which the Grand Duke of Baden presided. I exhibited the phonograph to 15,000 people, and they all heard it deliver a speech in good German."

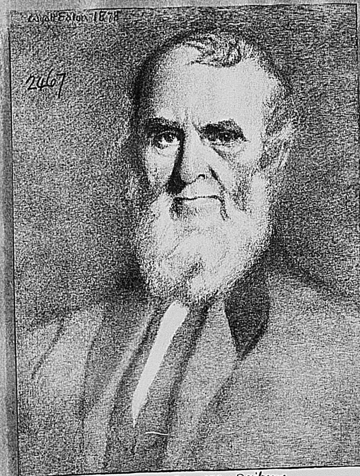
"Didn't they make you a Count, or Duke, or something over there?"

"No—no, not quite so bad as that. I am still a plain American citizen and wear the same size hat as when I started. When I first exhibited the old phonograph over there France made me a Chevalier of the Legion of Honor. At the time of the Electrical Exhibition they advanced me a grade, making me an Officeur. This Summer they raised the ante again; made me a Commandeur, I believe they call it. At all events, it's the highest decoration of the Legion of Honor. Over in France they think a great deal of these decorations. A great many privileges go with them. The Minister of Foreign Affairs gave me this one through Minister Reid, sending a very nice letter with it. At Mr. Reid's house they tried to get the ribbon and cross around my neck, but I wouldn't have it there. While I was in Europe I also had the phonograph exhibited before Queen Marguerite at Venice and the King at Rome, and he, too, conferred on me the highest order of the Legion of Honor. I don't know yet the prizes at Paris. They hadn't been awarded when I left."

"Did you hear much about the World's Fair of 1892?"

"Oh, yes; everybody at the Paris Exposition is talking about it. The place? Why, New York, of course. Frenchmen have never heard of Chicago. It would be like holding a French exposition in Marseilles, or an English fair in Belfast. If it is held in New York, I know that many of the Paris exhibitors will send their exhibits here. They ought to build a tower 2,000 feet high for the World's Fair. But if New York wants the Fair why doesn't she raise the money for it? When the Paris Exposition is over I shall bring my exhibit back here and store it for the World's Fair."

Mr. Edison found the electrical wires underground in London, Paris and Berlin. They have no trouble with their subways and have no explosions.



J. G. Whittier Aug 1879 Scribners

2468

SUPPOSED TO BE MR. EDISON'S DAUGHTER.

Dresden, Jan. 18.—An American woman, said to be the daughter of Mr. Edison, was, while on the journey from Vienna to Berlin, taken ill at the station here. It was found she had the smallpox, and she was sent to the hospital.

1890

Mrs. Edison said last night, at her home in Llewellyn Park, that her stepdaughter, Marion, who was studying in Dresden, had been taken ill three weeks ago, but she did not know with what complaint. The family had not heard that Miss Marion was suffering from smallpox. She is seventeen years old. Mr. Edison has been suffering from a mild attack of the influenza for three or four days. Jan 19 189-

How Edison Lost $250,000.

A demurrer to the bill of complaint of Thomas A. Edison against Ezra T. Gilliland and John C. Tomlinson, asking for an accounting, was argued before Judge Wallace in the United States Circuit Court yesterday. Mr. Edison alleges that in May, 1888, the defendant sold stock in the Phonograph Company to Jesse H. Lippencott, of Philadelphia, for $750,000, of which sum he only received $500,000. He further alleges that the defendants, by falsely representing to him that only Lippencott was willing to pay $500,000 for the stock, received his consent to the sale at that price.

2469

THE SALE OF THE PHONOGRAPH.

N.Y. Star —— Jan 19/1889.

Harsh Stories of Deceit and Treachery—Mr. Edison Is Said to Have Received Only $500,000, When He Should Have Been Given $750,000—Mr. Tomlinson Has Been Removed from Offices of Trust and Profit—Reticence of All Concerned—A Suit Against Tomlinson to Be Begun, It Is Alleged.

The electric world had another sensation esterday in the shape of a story to the effect hat John C. Tomlinson, a well-known lawyer of this city, and the former confidential friend and legal advisor of Thomas A. Edison, had defrauded the Wizard of Menlo of a large sum of money. The story as it came out is briefly as follows:

In 1880 Mr. Edison's business affairs became so extensive that he took the advice of his friends and secured Mr. Tomlinson to look after his varied interests. Besides being Mr. Edison's personal legal adviser, Mr. Tomlinson soon became a trusted friend, and Mr. Edison endowed him with power of attorney and secured for him the position of counsel for the Edison Electric Light Company. He enjoyed the full confidence of both Mr. Edison and the company, and soon achieved a prominent place in the legal world, besides enjoying a handsome income.

When Mr. Edison had perfected his phonograph, so the story goes, he directed Mr. Tomlinson to put it upon the market, either by getting up a stock company or selling the patent rights to others. Mr. Tomlinson immediately undertook the task, engaging as an agent Mr. E. T. Gilliland of the Empire Electric Company. Then comes the remarkable statement that Tomlinson sold the patent rights of the phonograph ostensibly for $500,000, but in reality for something like $750,000, the difference between the two amounts being divided between himself and Agent Gilliland. Then the story goes on to say when Mr. Edison discovered that he had not received the full amount he asked for an explanation, followed by the exposure of the deception, and the realization that a man whom he had regarded as a friend and given a start in life had betrayed his confidence.

The intimate friends of Mr. Edison say that he is a very tender-hearted man, and his grief at the discovery was intense. He decided to keep the matter quiet, but considered it his duty, however, to notify the Edison Electric Light Company of the character of their attorney. The alleged perfidy of his legal adviser was brought before the Law Committee of the Edison Company in the form of affidavits. The Law Committee was composed of ex-Judge Noah Davis, Edward H. Johnson, president of the company, Mr. Smithers and Mr. Wright, of Drexel, Morgan & Co.

The gentlemen were astounded at the revelations made, and were for a time inclined to believe that Mr. Tomlinson was the victim of some terrible misunderstanding. An investigation was undertaken, under the supervision of ex-Judge Davis, and the proofs of the charges were found to be so strong that all doubt was dismissed, and Mr. Tomlinson is no longer the counsel of the Edison Electric Light Company. Then, it is said, Mr. Tomlinson's retirement from other positions of trust quickly followed. They were mainly places he had held through the influence of Mr. Edison.

All the parties concerned have evidently determined to protect Mr. Tomlinson from the disgrace which publicity would bring to him. Owing to this fact it is impossible to obtain a direct verification of the story as recited above. The fact that Mr. Tomlinson is no longer the legal adviser of Mr. Edison was admitted yesterday by Mr. Edison, as was also the truth of the statement that Mr. Tomlinson has been supplanted by his former law partner, Mr. Dyer, as counsel to the Edison Electric Light Company.

A STAR reporter called at the office of Mr. Tomlinson in the Drexel building. He positively declined to say a word about the matter. A visit to Mr. Gilliland at his office, No. 18 Dey street, resulted in an emphatic refusal on the part of that gentleman to talk.

Ex-Judge Noah Davis would not say a word in reference to the ugly charges against Mr. Tomlinson. It was learned from a reliable source, however, that Mr. Edison, now that the story is out, has reconsidered his former determination to shield his former friend from the publicity incident to legal proceedings. Suits will probably be instituted against Gilliland and Tomlinson. Ex-Judge Davis said that Tomlinson is a man of considerable ability, is conversant with electric matters and is a thorough patent lawyer.

The patent rights of Edison's phonograph were sold last July to the North American Phonograph Company. The final negotiations were between the president of the company, Mr. Lippincott and Mr. Tomlinson. It was Gilliland who found the purchaser. Mr. Lippincott, it has been said, gave Tomlinson $750,000 for the patent rights, but only $500,000 ever reached the hands of Mr. Edison. Mr. Lippincott, when seen yesterday, also declared himself a member of the society of mutes, which has suddenly been organized among gentlemen connected with electrical affairs. He referred the reporter to his lawyer. The latter was talkative, but non-committal. He said that the publications about Mr. Tomlinson had greatly surprised him.

Joseph S. Auerbach, whose office is in the Mills building, is an intimate friend of Mr. Tomlinson, and is one of the counsel of the North American Telephone Company. He was asked to give his friend's side of the story, upon his admission that he was in full possession of the facts of the case. He declined to talk at first, but finally said that Mr. Tomlinson had been removed as counsel for the Edison Electric Light Company because of the affair alluded to, but not because he had wrongfully retained money that should have been turned over to Mr. Edison. The estrangement between the inventor and his legal adviser, Mr. Auerbach continued, was the result of a misunderstanding on another matter.

At West Orange, N. J., yesterday an effort was made to see Mr. Edison about the affair. Mr. Tate, Mr. Edison's secretary, said that he was sound asleep and could not be awakened under any circumstances. Mr. Tate also said that before he went to sleep, after two days and two nights of arduous brain work, he had left explicit orders that nothing concerning the alleged misconduct of his late lawyer, Mr. Tomlinson of New York, should be given to representatives of the press. Later Mr. Edison awoke and when his visitor's errand was stated he refused to say a word about the case, nor would he answer a single question about Mr. Tomlinson.

2470

WHY EDISON IS ANGRY.

THE TOMLINSON-GILLILAND SIDE OF THE UNFORTUNATE PHONOGRAPH TROUBLES.

Jan 19 1889. Eve Sun

According to This Mr. Edison Knew That the $250,000 Margin Had Been Paid, but He Was Angry Because the Amount, Being Paid in Cash Instead of Shares, Seemed to Indicate That Too Good a Bargain Had Been Made by Them.

The story of the trouble between Edison and Tomlinson over the sale of the phonograph, as originally published in THE EVENING SUN, has kept the electrical world agog ever since, and excited a keen interest in the scandal in the public at large.

The disclosures have finally broken the reserve which both parties in the transaction were anxious to maintain. The attempt to pooh-pooh or brush aside the story with a sweeping denial has been abandoned, and the facts in the case are coming to the surface.

We are able to-day to give the Tomlinson-Gilliland side of the story, as furnished us by a qualified authority. According to this informant:

Mr. E. T. Gilliland (now connected with the Non-Magnetic Watch Company, 177 and 179 Broadway) was, until the recent unpleasantness, closely allied and very intimate both in a social and business way with Mr. Edison.

Mr. Lippincott, now President of the North American Phonograph Company, was interested in the graphophone, a rival and antagonistic invention. Mr. Lippincott came to Mr. Gilliland and said in substance that the competition and legal warfare which would arise when both machines were put on the market would result in a great deal of expense. It would lead to a damaging cutthroat warfare.

He suggested, therefore, that perhaps Mr. Edison would be open to a combination of the two interests which would be mutually profitable; how, at that time, Mr. Gilliland held a contract from Edison, whereby he controlled the sale of the phonographs for the United States, by which Edison would obtain $12 and Gilliland $7 on each phonograph sold. Mr. Gilliland at this time was on the most friendly terms with Edison, and actively co-operating with him in improving and manufacturing the phonograph. He told Mr. Lippincott that he would see Edison and ascertain Edison's views on the combination suggested.

But instead of going to Edison personally he sent Tomlinson. Tomlinson found Edison willing and ready to effect such a pooling, he to have $350,000 cash for the patent for North America. Tomlinson reported this to Gilliland, who stated $350,000 was not enough, and told Lippincott that the price would be $500,000. This was for Edison's interest in the business.

Subsequently Lippincott had an interview with Edison and found that he wanted certain reservations made such as a royalty on each machine, a guarantee that a certain number of machines would be sold, and the right to manufacture them for the new pool. Lippincott refused to acquiesce in these conditions except so far as to yield the right of manufacture. On this basis the deal was completed and the $500,000 paid.

But Gilliland had a contract with Edison, of which mention has been made, and this had now to be considered. Without a transfer of this contract Lippincott could do nothing. Gilliland placed its value at $250,000. Lippincott offered $250,000 in guaranteed stock of the new company. This was accepted. Mr. A. O. Tate, Edison's private secretary, wrote out the contract and Gilliland signed it at the time Edison signed his.

The following day Tomlinson, at Gilliland's request, called on Lippincott for a more formal guarantee than he had given. Lippincott then proposed that he would pay Gilliland the cash in instalments, if that was more agreeable, or Gilliland, as Lippincott expressed it, might hold on to the stock and "wait for a boom."

Gilliland took the cash and it was thus that the $250,000 deal came in. It was the sum paid Gilliland for the contract and interest he had in the Edison phonograph. When Edison learned that the amount paid Gilliland was so large he was much surprised and became very angry, and the business and personal relations between him and Tomlinson ceased. Edison knew that Gilliland was to get $250,000 in stock, but supposed, as did Gilliland at the time the deal was made, that the payment was to be in stock of the North American Phonograph Company, and not in cash.

The above is an authoritative statement of the Tomlinson-Gilliland version of the story. It will be seen that the margin of $250,000 between the cost of the phonograph to Lippincott and the sum paid to Edison is admitted, but it is claimed that this amount was paid, with Edison's knowledge and acquiescence, and that he grew indignant only when it became apparent that the stock was equivalent to cash at par. Perceiving this, it struck him that Tomlinson and Gilliland had made too good a bargain for Lippincott, and had some guilty understanding with him.

But whatever the explanation is, the facts show that the case, as presented to a committee with so distinguished a lawyer as ex-Judge Noah Davis at its head, did not clear the parties under investigation. As a result of this private trial, Tomlinson was dismissed for unprofessional conduct, and neither he nor Gilliland have since had any standing with Edison or those associated with him.

Now that the trouble has come to the surface it is not unlikely that litigation will follow. The chief difficulty seems to be that while the go-betweens were guilty of a breach of faith, they were careful to keep within legal limits. They may have sacrificed Edison's interests, but not in a way that the courts can remedy. Edison feels that his confidence was grossly abused, but he hesitates to go to law for the reason stated, and also because of the very disagreeable nature of the case and the interruption and distracting effects of a big legal contest.

2471

EDISON'S QUARTER MILLION.

It Is Rumored that He Will Sue Tomlinson and Gilliland for It.

N.Y. Herald —— Jan 19 1889.

SILENT ELECTRICIANS.

There Are Many Who Know the Facts, but Few Will Tell.

The HERALD's exclusive story of the causes that led to the estrangement of Inventor Thomas A. Edison and his long trusted counsel and personal friend, Mr. John C. Tomlinson, the well known patent lawyer, was read with absorbing interest yesterday by electricians, the thousands interested in the inventions of the Wizard of Menlo Park and many others.

Mr. Edison, as on the previous day, was extremely reticent, and contented himself with expressions of sorrow that Mr. Tomlinson's own imprudence had brought into the full glare of publicity a transaction that would have remained hidden to the world forever had he kept his mouth shut. He declined to say whether he would begin proceedings for the recovery of the money that had been illegally diverted from its destination, but a friend who has his full confidence expressed his belief that litigation would speedily be resorted to.

CLOSE MOUTHED FRIENDS.

In every place where electricians congregate the HERALD's story was almost the sole topic of conversation. Even those who had long known, in a general sort of a way, of the estrangement between the two old friends were astonished at the developments in the HERALD's exposure. Those who were better informed smiled knowingly and discussed the subject freely among their intimates, but were particularly close mouthed when approached by reporters. They all acknowledged, it is true, that the HERALD's outline of the facts was substantially correct, but when asked to point out in what respect it it was wrong declared that the controversy was one that concerned Messrs. Edison, Tomlinson and Gilliland only, and not the general public, and that they did not desire to talk about it.

One gentleman, who declined to allow his name to be used, told me that Mr. Tomlinson when first retained by Mr. Edison was a struggling young lawyer with plenty of brains, a good knowledge of electricity and the patent laws and an extremely modest income. This was in 1880, when Mr. Edison, whose labors were beginning to be appreciated, was advised to secure the services of a competent man—a lawyer if possible—to look after and manage his rapidly increasing business.

A SNUG LITTLE INCOME.

Mr. Tomlinson, who had been previously known by Mr. Edison and who possessed the necessary qualifications, the inventor thought, was finally engaged to fill the position, and from that day his career has been a very prosperous one. The business of Mr. Edison alone, involving as it does the looking after a score or more of extremely valuable inventions, was a source of considerable income, but when to this was added the clientage of the Edison Electric Light Company—which was obtained for him through the personal influence of the generous inventor—his receipts must have amounted to at least $25,000 or $30,000 a year.

Mr. Tomlinson was graduated at Columbia College about thirteen years ago, and is now thirty-two years old. He does not look his age, being stout, full faced and entirely beardless. Up to five o'clock yesterday afternoon he had not spent over ten minutes in his office in the Drexel Building. I called there several times, but was told at each visit that Mr. Tomlinson was out, but was expected every minute. My last call was at five o'clock, and as he had not then returned the search was abandoned. To an evening newspaper reporter he is represented to have said:—"I have no statement to make."

THE LAW COMMITTEE'S ACTION.

The law committee of the Edison Electric Light Company, upon whose recommendation Mr. Tomlinson's connection with that corporation was severed when Mr. Edison laid his complaint before the Board of Directors, consists of ex-Judge Noah Davis, chairman; Mr. Edward H. Johnson, the company's president; Mr. Wright, of Drexel, Morgan & Co., and Mr. Smithers. Such of these gentlemen as could be found utterly declined to say anything about the subject. One of the number, however, tacitly admitted that Mr. Edison would probably bring suit against Messrs. Tomlinson and Gilliland.

President Johnson and ex-Judge Daly both said they preferred that the story should be made public by Mr. Edison if it was to be made public at all. Both admitted, however, that Mr. Tomlinson's connection with the company as counsel had terminated some time ago, although neither would definitely assign a reason for the severance of relations that had existed since the formation of the company.

KNEW BUT WOULD NOT TALK.

"I have known the facts for months," said an electrician, who was a telegraph operator with Mr. Edison many years ago, "but I shall not give them away without Mr. Edison's permission. When the full story is told—if such a thing ever comes to pass—I think the public will read the history of acts of ingratitude which have few equals in ancient or modern times. Mr. Edison has always been kind and considerate to the men who work with him, and he is the only considerable employer I know who has successfully adopted the co-operative system. The HERALD told this morning how part of the money received for the phonograph had been divided among the sixteen workmen who aided in its perfection, but this is only one instance out of many. Whenever a company is formed to promote one of Mr. Edison's inventions, a certain proportion of the stock goes to the workmen."

SPEECHLESS GILLILAND.

Mr. Ezra T. Gilliland, who is at present with the Empire City Electric Light Company, said that he had nothing to say just at present, but the mysterious manner in which he spoke was calculated to make one believe that at the proper time he would be able to say a great deal. President Lippincott, of the North American Electric Light Company, whom I found at No. 160 Broadway, referred me to his counsel, Mr. J. Adriance Bush, of No. 10 Wall street. I saw that gentleman, but was told that professional etiquette forbade his saying a word upon the subject further than that the quarrel between Messrs. Edison and Tomlinson would not in the least affect the company.

2472

SALE OF THE PHONOGRAPH.

Times Jan 19 1889

SAID TO HAVE CAUSED EDISON AND HIS LAWYER TO FALL OUT.

A story has been put in circulation respecting the business relations between Mr. Thomas A. Edison, the inventor, the Edison Electric Light Company, and Mr. John C. Tomlinson, the lawyer. The basis for it seems to be that the lawyer some months ago ceased to act as counsel for the inventor or the corporation by reason of a misunderstanding which, it is said, grew out of the sale of the phonograph patents to Mr. Jesse H. Lippencott of Pittsburg, since elected President of the North American Phonograph Company, which also controls the Taintor-Bell graphophone patents. It is said that the negotiations of the sale were conducted by Mr. Tomlinson, and the price is variously given at $500,000 and $750,000.

The point of the story is that Mr. Edison was not satisfied with the lawyer's doings, and not only severed the relationship, but instigated similar action by the electric light company. The facts are reported to have been investigated by a Director of the company. The rupture has been carefully concealed until the present time, and even now the persons most interested refuse to furnish any information. There has been no litigation, and, so far as could be learned yesterday, there is no prospect of a civil or criminal action.

The legal representative of the North American Phonograph Company is authority for the statement that the corporation or the subcompanies are in no way implicated, as the breach occurred before the parent charter was obtained in July. Mr. Tomlinson only returned from Europe recently, and both he and Mr. Edison appear to be very much annoyed at the publicity given their private affairs.

It is recalled that when Mr. Edison sold out to Mr. Lippencott the price was announced at $1,000,000. The phonograph company's lawyer said that only Messrs. Edison and Lippencott and possibly Mr. Tomlinson knew what the price actually was. The company, he said, would not sell out for many millions and will begin supplying machines for practical use Feb. 1.

EDISON LOST A FORTUNE

Press Jan 19 1889

A Quarter of a Million Dollars Which His Phonograph Didn't Make.

2473

PROFITS OF HIS LAWYER

John C. Tomlinson, Whom the Inventor Made Wealthy, Reported to Have Resorted to Sharp Practices with His Benefactor—He Is No Longer Mr. Edison's Lawyer and May Be a Defendant in a Lawsuit—How the North American Phonograph Company Got the Phonograph.

The story published in yesterday's PRESS to the effect that Inventor Thomas A. Edison had discharged his patent lawyer, John C. Tomlinson, because the latter had not obtained as much as he should for Mr. Edison's phonograph, has been fully verified. Mr. Edison, it is said, has lost about $250,000, and principally through the negligence, or worse, of a man he had made wealthy.

Mr. Edison himself was exceedingly reticent about the matter yesterday, although admitting the truth of the story.

A very close friend of the inventor was more communicative. This gentleman said Mr. Tomlinson was a struggling lawyer when Mr. Edison met him. The professor threw all the business possible in his way. The acquaintance of the two ripened into the warmest friendship. Eight years ago Mr. Tomlinson took charge of all Mr. Edison's legal affairs. Later on the young lawyer made himself so indispensable to Mr. Edison that he made him attorney for the electric light company.

Tomlinson's revenue from the company became soon so large that he hired nicely furnished offices at 40 Wall street and became, through his ability, one of the best known patent lawyers. In July last Mr. Edison desired to capitalize the patent of his phonograph. His laboratory work kept him so occupied that he had little time to devote to business details. Whether at the suggestion of Mr. Tomlinson or some one else does not transpire, but Mr. Edison engaged E. T. Gilliland, a practical electrician, at a salary of $6,000 a year, to help raise the money necessary. The agreement was that he should receive 150 shares of stock in the new company and Tomlinson 300 shares. Gilliland and Tomlinson worked hard to secure the cash, and finally interested Jesse H. Lippincott of Pittsburg in the scheme. One day the two called upon Mr. Edison and informed him they had been offered $500,000 for the invention. So far as THE PRESS informant could learn the professor was not satisfied with this offer.

He believed his contrivance to be worth more. On asking his agents if they could secure no better terms, they are said to have assured him that $500,000 was the limit. "The Wizard" after much hesitation agreed to these terms. Tomlinson drew up a bill of sale, the cash was paid and the valuable invention became Mr. Lippincott's property.

The Pittsburg gentleman lost no time in forming a corporation. He interested C. A. Cheever, the rubber dealer of this city, and Pennsylvania capitalists in the enterprise, and the stock went off like hot cakes, Messrs. Tomlinson and Gilliland being permitted to retain the shares agreed upon at the outset. The North American Phonograph Company was incorporated and the stockholders were laughing in their sleeves at the ridiculously low price at which they had purchased the phonograph, when Professor Edison was given a tip that not only astonished but finally grieved and enraged him. It was that Mr. Lippincott had actually paid $750,000 instead of $500,000 to Messrs. Tomlinson and Gilliland.

Immediately the inventor instituted an investigation for the purpose of ascertaining where the additional $250,000 had gone to. It took him not a great while to discover that Tomlinson had charged not less than $62,500, and some say $70,000, for the onerous task of drawing up the bill of sale. Whether Gilliland had pocketed the remainder of the $250,000, or had divided it with Tomlinson, THE PRESS man's informant was unable to positively state. Professor Edison was loath to believe that he could have been tricked by a man whom he had lifted from comparative obscurity and poverty to no inconsiderable fame and wealth. He summoned Tomlinson to his presence, and that gentleman indignantly denied that he had in any way wronged him. "The Wizard" nevertheless proceeded to sift the thing to the bottom.

Further inquiry resulted in his gaining possession of affidavits, which he presented before the law committee of the Edison company. This consists of ex-Judge Noah Davis, chairman; Edward H. Johnson, president of the company; Charles Smithers and Mr. Wright of Drexel, Morgan & Co. Both Professor Edison and Mr. Tomlinson appeared before the committee and told their stories. A member of it is said to have remarked that sufficient evidence was deduced to at least prove Tomlinson guilty of a serious breach of professional honor, in misrepresenting a transaction to a client, than which offense none is regarded more base by the members of the Bar.

Whatever may have been the character of the committee's report it apparently was not complimentary to Mr. Tomlinson, for three weeks ago he was compelled to sever his relations with the company, and with that an income variously estimated at from $30,000 to $50,000 a year.

Mr. Gilliland is no longer associated with the Edison company, either. With neither of them is Mr. Edison now on speaking terms. On the other hand, it was asserted yesterday that suit would be brought very soon to ascertain what right Messrs. Tomlinson & Gilliland have to the $250,000 they are declared to have cleared by reason of the phonograph sale.

Those most intimately acquainted with the details of the story above rehearsed were mute yesterday. Professor Edison would say little besides uttering an expression of regret that the "unpleasantness," as he called it, had become public property. He declared that Tomlinson alone was responsible for this, inasmuch as that gentleman had gone about and explained it all to many from his own point of view. "Had he kept his mouth shut," said Mr. Edison, "perhaps the outside world would never have heard of the matter."

Ex-Judge Noah Davis, chairman of the Law Committee, was equally unwilling to express his views yesterday. "As this matter may and probably will be the subject of litigation, and as I occupy confidential relations with the company, it would be unbecoming in me," said he, "to discuss it now. I certainly should not feel at liberty to do so until I have consulted with the other members of the committee and they deemed it wise."

"Has Mr. Tomlinson been adjudged guilty of the charges brought by Mr. Edison and dismissed from the employ of the company?" Judge Davis was asked.

"Don't say dismissed," he said. "To be sure he is no longer attorney for the corporation. Mr. Dyer acts in that capacity. I regret that this matter has become public property. It concerns only Mr. Edison, Mr. Tomlinson, Mr. Gilliland and the company."

About seven years ago, when young Tomlinson had been admitted to the bar only a year or so, he was a protege of ex-Senator Thomas E. C. Ecclesine, in whose office he served a clerkship. Later on the ex-Senator took Tomlinson into partnership and used his political influence and connections constantly to push the young man. Such plums as counsel for contesting Assembly candidates and before legislative committees were thus secured for Tomlinson, who, despite a naturally awkward manner and appearance, spoke forcibly and effectively. Just before Edison's attention was attracted to him by his management of a patent case, Tomlinson was said to have had political ambition. He took an active part in the local politics of an up town ward as a County Democrat, and aspired to a nomination for the Assembly. Soon after his appointment as counsel to the electric light company, however, he devoted himself to business industriously and dropped his old partner—Ecclesine—and politics together, though he retains his membership in the Young Men's Democratic Club.

When a PRESS reporter called upon Mr. Tomlinson at his office in the Drexel building yesterday the young patent lawyer was exceedingly reticent and mysterious. When asked as to the truth of the report that he had sold the phonograph for $250,000 more than Mr. Edison received he replied emphatically:

"There is nothing in it." In answer to further questions he would only say: "I have nothing to say and must decline to be interviewed."

N.Y. Morning Journal

A SHOCKED WIZARD

Edison Hoodwinked in the Phonograph Deal.

2474

A QUARTER MILLION GONE.

A Great Lawsuit Will Probably Come of It.

1889 Jan 19

"Two hundred and fifty thousand dollars missing."

These words were uttered not long ago by Thomas A. Edison, the great electric inventor, and the conclusion thus announced was the result of an investigation that Mr. Edison had been making into his business affairs.

Some years ago Mr. Edison invented the phonograph. At first the invention was not considered by Mr. Edison as of great mercantile value, but he seemed to regard it as a pretty toy. However, he formed a company to push the new invention. Edward H. Johnson, the president of the Edison Electric Light Company, was named as the president of the new company. As time passed on Mr. Edison saw that there were great mercantile possibilities in the invention, so he cast around for a means to put it upon the market.

Ten years ago Mr. Edison became greatly interested in John C. Tomlinson, a rising young lawyer in this city. Up to the time that Mr. Edison took up Mr. Tomlinson he did not have a large practice. He is about thirty years of age, and lives at No. 222 West Forty-fourth street. As soon as he was taken up by Mr. Edison his practice at once enlarged until he was doing a business of about $30,000 a year. He had all of the private practice of Mr. Edison, and farther, through his patron's interest, was made the general counsel of the Edison Electric Light Company. The business thus placed in his hands was of the greatest importance, as he had all of Mr. Edison's patents to look after.

When Mr. Edison completed his phonograph, he engaged E. T. Gilliland, a bright young electrician, then in the employ of the Western Electrical Company, at a salary of $7,000 a year, to take hold of the new invention, as a sort of selling agent. Mr. Gilliland was given a power of attorney by Mr. Edison to sell the phonograph to any syndicate of capitalists, with the understanding that in all his business transactions he should consult with Mr. Tomlinson.

At first Mr. Gilliland found some legal complications in the way of selling the phonograph, because the company that had been organized with Mr. Johnson as president claimed to have certain rights in the matter, but a compromise was effected, by which the members of the old company were given a share in a new concern, and the patents held by Mr. Edison and the old company were merged in a new organization, incorporated as the North American Phonograph Company, with a capital of $2,000,000. Mr. J. H. Lippincott, of Pittsburg, was the heaviest investor in the new company.

Aside from the salary paid to Mr. Gilliland and the money to be given to Mr. Tomlinson as attorney, Mr. Tomlinson was to receive 300 shares and Mr. Gilliland 150 in the stock of the new company.

Early in last July the sale of the invention was announced to Mr. Edison, the purchase price agreed upon being $500,000. This was not looked upon as a large amount of money, but as the inventor and others interested were given some stock in the new concern, it was fairly satisfactory to Mr. Edison. After the sale Mr. Tomlinson and Mr. Gilliland went abroad for a few months.

Not long after it was reported to Mr. Edison that the purchase price of $500,000, given as the result of the bargain with the promoters of the North American Company, was not the exact sum that was paid, but that in reality $750,000 had been the purchase price.

Then Mr. Edison engaged in a computation, which gave rise to the remark that "$250,000 were missing." He at once instituted inquiries and found that Mr. Tomlinson had been paid $62,500 for his legal services in drawing up the necessary papers transferring the title in the phonograph from the inventor to the North American Company, and he surmised that the remainder had gone into the possession of Mr. Gilliland, possibly. At all events the balance was missing and, look at it as he might, Mr. Edison saw that he was $250,000 poorer on the deal.

He gathered all of the documents, affidavits and other facts in the case, and presented them to the Law Committee of the Edison Electric Light Company, as this organization, or rather some of its stockholders, were interested in the North American Phonograph Company. The gentlemen comprising the Law Committee in question were: Ex-Judge Noah Davis, as chairman; Edward H. Johnson, of the Edison Electric Light Company; Mr. Wright, of Drexel, Morgan & Co., and Mr. Smithers, also of the Edison Electric Light Company.

After investigating the subject carefully, a secret report was made and Mr. Tomlinson's resignation was accepted as the general counsel of the electric light company, and Mr. Edison transferred all of his business from Mr. Tomlinson's hands to that of another attorney. This transfer was made with little noise, Mr. Edison and only the people directly interested making any revelations of their suspicions as to where the $250,000 had gone. Mr. Gilliland, too, was no longer in the employ of the Edisons and has since then effected an engagement with the Empire City Electric Company, at No. 15 Dey street. Mr. Gilliland, to a JOURNAL reporter yesterday, refused to make any statement as to his dealings with Mr. Edison.

"That I have been guilty of any wrongdoing is positively false," he added.

Mr. Tomlinson, too, was equally taciturn. "I have no statement to make," said he, "other than that all my dealings with Mr. Edison have been perfectly straightforward."

President F. E. Lippincot, of the North American Phonograph Company, at No. 160 Broadway, referred the reporter to his attorney, J. Adriance Bust, of No. 10 Wall street. This gentleman said that the North American Company were in no way interested in any fight between Mr. Edison, Mr. Tomlinson and Mr. Gilliland, and that he could see no reason why he could with propriety make any statement about the trouble.

Joseph S. Auerbach, of the firm of Lowery, Stone & Auerbach, whose offices are in the Mills building, said that he was the counsel for the North American Phonograph Company, and at the same time was a lifelong friend of Mr. Tomlinson's, having been graduated from the University of the City of New York in the same class with him before the young lawyer entered the law school in Columbia College.

"There is a difference of opinion existing between Mr. Tomlinson and Mr. Edison," he said, "over financial matters connected with the sale of the phonograph to our company, but as I understand it Mr. Tomlinson has done nothing that will in any way place him before the world in any other than the most honest light."

It is understood that Mr. Edison will begin suit against Mr. Tomlinson and Mr. Gilliland for the recovery of $250,000 which he thinks should be his, and that all of the facts presented to the Law Committee by Mr. Edison and which are now in the possession of ex-Judge Noah Davis will be brought out at the trial. Mr. Tomlinson has moved his office from No. 40 Wall street to the Drexel building. He passed an hour there yesterday, but refused to see anybody during that time. A great story, showing the millions coined in electric enterprises, will appear in to-morrow's JOURNAL.

2475

Elec Rev. **Ore Separator.** 1889 Mch 30

The Edison magnetic ore separator is to be tried on a large scale near Bechtelsville, Penn. A 150 horse-power engine, a Brennan crusher, three pairs of corrugated rolls and necessary conveyers, pockets, belts, etc., have been installed, and two 80 horse-power boilers. Mr. O. S. Hussey, formerly of the Edison Laboratory, is superintendent of the plant, and is mystifying the local scribes by his uncommunicativeness.

2476

NY Elec. Review **The Magnetic Ore Separator.**

It is reported that experiments are soon to be made with one of Edison's most recent inventions, the object of which is to concentrate the real ore dug from a mine and get rid, by mechanical means, of all dirt and earthy matter that interferes with smelting. This machine it is claimed will reduce immensely the cost of smelting and bring into use ores that cannot now be profitably worked. New York capitalists have purchased eight acres of iron ore land, where the experiments will be made. They have been incorporated under the name of the Pennsylvania Concentrating Company. Buildings and machinery are now being put up at a cost of $35,000. The rock containing the ore, after passing through the crusher and broken to the size of an egg, is dumped into a large hopper. From here it drops down an incline within a few inches of a powerful magnet, as recently exclusively illustrated in the REVIEW. This will be so heavily charged as to draw the ore from its course into one channel, and the rock and other foreign elements contained in the ore are permitted to pass through another channel to the refuse pile.

Apl 20 1889

2477

The Fritsche Wheel Dynamo.

We are indebted to our esteemed contemporary *Industries* for the following description of this unique machine:

This is a type of machine simultaneously evolved in France by M. Desrozier, and in Germany by Herr Fritsche. Both these gentlemen will probably claim that the machine of each is essentially different from that of the other; but to impartial electricians the difference will appear to be rather one of detail than of principle. As far as the principle is concerned, these gentlemen

ELEC. Rev. April 6 1889.

have indeed come back to a very old machine, which originated some seven or eight years ago in England, the Elphinstone-Vincent dynamo. M. Desrozier has taken up this type, and so far improved its details as to produce a good, serviceable machine, which is now being made by the Maison Breguet, Paris. A number of these machines are now at work, chiefly on board ship, and are giving satisfaction. One of the most current sizes has an output of 170 amperes at 105 volts pressure, the speed being 350 revolutions per minute. The electrical efficiency is given by the inventor as 83.2 per cent., and the weight 24 cwt., or almost exactly 1 cwt. per horse-power output.

In the Desrozier machine the armature conductors are of copper and arranged radially, the connection between their ends, both outside and inside, being made by segmental strips, and there is as usual a separate commutator. In all these details the Fritsche machine is different, though its principle is the same, viz: that of a disc armature without iron core revolving within a multipolar field, the lines of which are parallel to the spindle. In the Fritsche armature the conductors are of iron, to reduce the magnetic resistance of the interpolar space, and they are not placed radially, but with a certain rake, by which arrangement the segmental conductors are dispensed with. Finally, there is no separate commutator, the collection of current taking place at the outer periphery of the disc. In all these details, then, the machine is quite original, and different from other disc machines. The following description is based upon the German patent specification of this machine, supplemented by some notes which the inventor has been good enough to forward to us. The specification is a very interesting document, and thoroughly German in its leading idea. It is, in fact, a complete treatise of drum winding as applied to both a cylindrical surface and the surface of a

disc. Starting with the ordinary method of drum winding introduced by Herr Hefner von Alteneck for two-pole machines, the inventor shows how from this can be evolved a modified winding by placing the conductors spirally so as to avoid the necessity of end connection, how the winding can be arranged so as to obtain only two circuits though there may be more than one pair of poles, and, finally, how the shape of the pole pieces can be altered to avoid the differential action to which the spiral arrangement of the conductors on the armature would otherwise give rise. The inventor next applies the same train of reasoning to disc machines, and arrives at the peculiar form of winding represented in Fig. 3. This illustration shows the arrangement of conductors in an eight-pole machine. The rake of the conductors is such that the angle enclosed between their inner and outer ends is one-eighth of a complete circle or 45°. Thus two successive conductors come simultaneously under the influence of two neighboring poles, and the shape of the pole pieces is so chosen that no conductor is under the influence of two poles simultaneously. This is the reason for the peculiar form of the polar faces *N S*, shown in the diagram. The conductors or bars are arranged in two planes, one close behind the other. One set of bars rake one way and the other the opposite way, their outer and inner ends being joined by plates placed parallel with the spindle, the commutator segments being on the outer circumference, held apart by insulation, and having the brushes bearing directly on the rim of the armature. The current entering at the brush B_1 into the plate 11 (Fig. 3) divides between the bars, raking opposite ways, and flows successively through all the back and front bars in the direction indicated by the arrows, until it finally leaves the armature by the plate 1 and brush B_2. If the direction of the current entering the bar 11 and flowing downwards in the figure be followed, it will be seen that the current successively passes through the bars 12, 13 and so on, until it reaches the set of bars marked 1, through the last of which it flows upwards and out by B_2. Similarly the other half of the current entering the bar 11, and flowing to the left, traverses successively the bars 10, 9 and so on, until the last bar 1 is reached. There are 79 bars in each set, or 158 bars in all, and the tota E. M. F. is the sum of the electro-motive forces induced in the 79 bars which at any moment are in series. The bars are rigidly attached, and in metallic connection with the plates at their outer and inner ends, and are not insulated. Fig. 2 shows a complete armature, and Fig. 1 a complete 16-pole machine arranged for belt driving. The inventor claims that by the use of naked armature conductors, the possibility of the armature burning up under an excessive current has been entirely obviated; and that, in fact, this machine might be run with the armature conductors red hot without injuring the insulation. These machines are

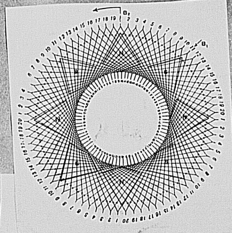


FIG. 3.—SHOWING WINDING OF ARMATURE.

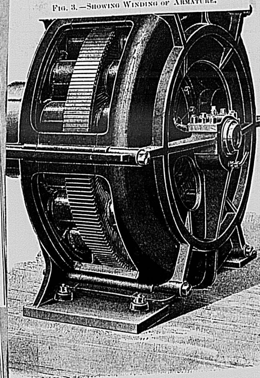


FIG. 1.—16 POLE FRITSCHE MACHINE.

designed for very low speeds, and are specially intended for direct coupling with ordinary slow speed steam engines. The following table gives some particulars of the current sizes, all intended to give a pressure of 110 volts:—

Speed.	Current.	Output.	Armature Resistance.	Weight. Cwt.	Weight. per h. p.
180	50	5,500		28	3.8
160	85	9,400	0.060	42	3.3
160	130	14,300	0.040	56	2.9
140	200	22,000	0.025	76	2.6
140	330	26,300	0.0138	102	2.9
110	540	59,400		140	1.75

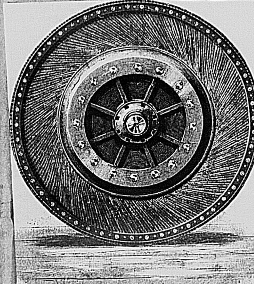


FIG. 2.—THE FRITSCHE ARMATURE, COMPLETE.

2478

Hypnotized by the Phonograph.

Ntl Elect. Rev. May 11 1889

Dr. Pinel, of Paris, is said to have succeeded in hypnotizing several subjects by means of the phonograph. All the commands given through this channel were, he declares, as readily obeyed as those which he had uttered directly, and "suggestions" of every possible sort were as effectually communicated through the medium of the machine as if made *viva voce*. The conclusion which he deduces from his experiments is that the received theory of a magnetic current passing from the operator to the subject is entirely baseless, and that the real cause of the phenomenon of hypnotism is nervous derangement on the part of those subject to them.

2479

May WAS MR. EDISON GULLED? 13/89

He Sues Gilliland and Tomlinson, Charging Broken Faith and Treachery.

THE WORLD recently announced that Thomas A. Edison had discovered that Ezra T. Gilliland and John C. Tomlinson had sold to Jesse H. Lippincott the agency held by Gilliland for the sale of phonographs for $250,000, in alleged breach of contract, and on representations that they received only $75,000. Suit has now been begun in the United States Circuit Court by Mr. Edison, charging Gilliland and Tomlinson with treachery and breach of faith and demanding an accounting. In his complaint Edison says that he induced Gilliland to join him in business by offering him a larger salary than he had been receiving from the Bell Telephone Company, and that he made Tomlinson wealthy by giving him large retainers as counsel. Gilliland was made general agent for the sale of the phonographs, but he agreed to hold this monopoly at the control of Edison. He further says that the defendants induced him to sell his 11,960 shares of the Edison Phonograph Company to Lippincott for $500,000, and then they sold the agency to the same person, virtually making him sole owner of the business. The defendants put in a general denial.

Mr. Tomlinson says that neither he nor Gilliland is a beneficiary of Edison, but, on the contrary, they have lost heavily through their connection with him. The sale of the agency was a perfectly fair and honorable transaction. He denies that they told Edison that they were to receive only $75,000, but that they had accepted $250,000 of the stock in the new company, and subsequently sold the stock to Lippincott for $250,000.

The case will probably come to trial in June, Edison's counsel being Col. Robert G. Ingersoll and Eaton & Lewis, while Frederic R. Coudert and W. Bourke Cockran are for Gilliland and Tomlinson.

MR. TOMLINSON SPEAKS AT LAST.

2480

HE AND MR. GILLILAND INTEND TO SUE NEWSPAPERS FOR THEIR PHONOGRAPH STORIES.

Mr. John C. Tomlinson, the patent lawyer, who has been brought into considerable prominence recently in connection with the sale of Inventor Edison's patent for the phonograph, broke silence yesterday for the first time and said:—

"Speaking for myself and Mr. Gilliland, I am unable to trace the publications which have recently appeared concerning the sale of the phonograph to the source from which they emanated.

"The persons who made them have concealed their identity. While they have not hesitated to impute the basest motives to us both they have been careful to refrain from giving their insinuations the support of their names.

"We have therefore resolved to take effective measures to compel our traducers to come out of the obscurity in which they have concealed themselves and to substantiate their statements in person or to retract them. To this end we have resolved to institute proceedings against the newspapers which have been made the chief agents for the dissemination of these slanders, so that their proprietors will be compelled in justification of the publications to reveal the names of the authors.

"We will be entirely satisfied to abide the decision of any jury that may be empanelled to determine the propriety of our conduct. In the meantime, we content ourselves with branding the statements as outrageous, unjustifiable, malignant and cowardly falsehoods."

EDISON SUES HIS AGENTS.

HE CHARGES THAT TWO OF THEM CHEATED HIM.

2481 1889

A LARGE AMOUNT OF MONEY INVOLVED—HIS STORY OF THEIR ALLEGED INGRATITUDE.

Thomas A. Edison, the inventor, began a suit in equity yesterday, in the United States Circuit Court, against Ezra T. Gilliland, who was one of Mr. Edison's trusted agents, and John C. Tomlinson, who was for several years the close personal friend and the attorney of the inventor. The complaint was filed yesterday afternoon by Eaton & Lewis, as Mr. Edison's attorneys, and Robert G. Ingersoll as counsel. Mr. Edison says in the complaint that for many years he "has been an inventor in electrical and other fields of scientific research," and that in the prosecution of his work he "has gathered about him assistants and employes, many of whom have become attached to him by ties of friendship as well as interest, and have given him their faithful devotion and have received his confidence and favor in return," and that he has been in the habit of giving such assistants stock in companies which have put his inventions upon the market, in place of salary or other compensation. He says of Gilliland:

He was, during the three years prior to the month of July, 1888, a confidential agent and friend of your orator. Prior to that time he was in the employ of the American Bell Telephone Company, in Boston, and was receiving a salary of five thousand dollars a year. Your orator urged him to come into his employ, and by way of inducement, guaranteed to Gilliland that in your orator's employ he would receive a larger sum annually than his salary then amounted to, for a period of five years. Gilliland thereupon accepted the offer of your orator, and went into his employ, and has since the date thereof, down to the month and year aforesaid, received, through the instrumentality of your orator, a larger income annually than the salary which he was receiving at the time that he entered into your orator's employ.

As to Tomlinson, Mr. Edison says:

Your orator made the acquaintance of Tomlinson about five years ago. The latter was then an attorney and counsellor at law, practising his profession in the city of New-York, but having an inconsiderable business and earning a small income in his profession. Tomlinson and your orator at once became close personal friends, and your orator conceived the desire and purpose to confer all possible benefits upon Tomlinson, so as to advance his position in his profession and increase his income. Your orator used his influence, therefore, in procuring for Tomlinson retainers from the various companies in which your orator was then director or stockholder, and your orator's efforts in that direction were successful to such an extent, that in the month of June, 1888, Tomlinson was receiving an annual retainer from each one of most, if not all, of such companies, the total of such retainers amounting annually to a very large sum or income. In addition to the retainers thus secured to the said Tomlinson, your orator appointed Tomlinson his personal and confidential counsel and adviser, and placed him upon the list of personal assistants and friends whom your orator was in the habit of rewarding for services in the manner described.

Mr. Edison says that he has been experimenting for three years with the phonograph, and has obtained patents in the United States, Canada and other countries, and that he organized in October, 1887, a corporation called the Edison Phonograph Company, to which he transferred some of his patents relating to phonographs. He received $1,196,000 in stock out of the $1,200,000 capital and he gave 1,750 shares of $100 each to his assistants, including Gilliland and Tomlinson.

The Edison Phonograph Company made a contract on October 28, 1887, with Gilliland, whereby the latter was made the agent for the United States for the sale of the phonographs. He was to receive a commission of 15 per cent of the amount he paid for the phonographs delivered to him. Mr. Edison says that the contract was made by the Phonograph Company at his request, and Gilliland agreed to hold it subject to Mr. Edison's pleasure.

In May, 1888, Mr. Edison says, Gilliland and Tomlinson suggested to Mr. Edison the sale of his stock in the Phonograph Company. Mr. Edison was reluctant to sell, but was persuaded to do so and authorized the defendants, as his agents and counsel, to negotiate for the sale of the stock. Mr. Edison's associates, at his request, put their stock into his hands so that all of it might be sold together. The defendants succeeded in bringing about a sale of the stock to Jesse H. Lippincott, under a contract executed on June 28, 1888. As a part of the sale the Gilliland agency contract was to be transferred to the purchaser and the stock and contract were sold at the same time to Mr. Lippincott.

While the negotiations were in progress Gilliland and Tomlinson informed Mr. Edison of their intention to sell the agency contract for $250,000 in the stock of a company to be organized by Lippincott.

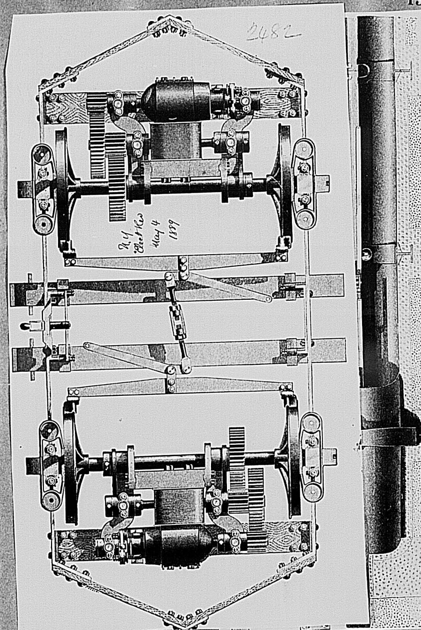
The complaint continues:

But these defendants at the same time represented to your orator that the stock aforesaid, to be received by them under agreement, for the contract, was of uncertain value and would not exceed under the most favorable circumstances a cash value of $75,000; whereas, the fact is, that at the time of such representation the defendants knew the same to be untrue and knew that they then held an additional agreement contemporaneous with the agreement between your orator and Lippincott, that if the sale of both Edison phonograph stock and Gilliland contract should be successfully accomplished, he would repurchase from them, at their option, the $250,000 of stock at par; that the defendants concealed from your orator such additional agreement with Lippincott, and your orator was not aware at the time of his signing and executing the agreement with Lippincott that, as a part of the same transaction, the defendants were to receive the $250,000 of stock, with an option to sell the same to Lippincott for cash, dollar for dollar; that your orator, if he had known the facts, would not have executed the agreement, and the defendants well knew that he would not have done so.

Mr. Edison charges that the defendants concealed the facts from him, knowing that if he were informed of them he would have asked a higher price for his stock in the Phonograph Company and would thus have imperilled the sale of the contract, which was of small value compared with the Phonograph stock. He says that he has been informed that Mr. Lippincott has paid Gilliland and Tomlinson the entire sum of $250,000, in addition to the amount paid for the stock, and that "the defendants in equity and good conscience hold that sum of money to the use and benefit of your orator."

He asks for an accounting for all sums of money paid to the defendants as Mr. Edison's agents.

2482



Electric Railway Work.—Side View and Plan, Double Motor Truck, Bentley-Knight Patents.

2483

Electric Welding.

We illustrate herewith apparatus specially designed for electric welding processes by Prof. Elihu Thomson, aided by Mr. Lemp, electrician of the Thomson Electric Welding Company. In the earlier days of experiment in this line, suitably modified electric lighting apparatus would give satisfactory results; but with its wonderful growth and advance, specially constructed apparatus was a necessity which was successfully met by Prof. Thomson and his able assistants,

glance, and a greater out-put of current is undoubtedly obtained than ever before, and at a very high efficiency. Its durability under the most trying conditions cannot be questioned, for even the earliest machines are in good condition to-day, uninjured by heavy hammering of the weld. This, however, is unnecessary, as an unhammered weld is fully as strong as the rest of the metal. Where a large amount of work in any particular metal is done, it is found advantageous upon work requiring longer

N.Y. Elect Rev. Mch 23 1889

2484

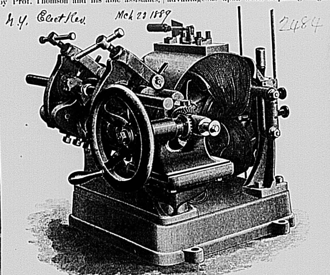


Fig. 1.—Transformer or Welding Coil of the Thomson Electric Welding Co.

so that now welding by electricity is performed quickly, economically and with absolute certainty even by unskilled hands.

Fig. 1 shows the transformer or welding coil. In it the secondary circuit is a copper tube. Through a slit made in this are slipped the coils of the primary circuit previously wound on a form; the iron disks have also a slot, by means of which they are slipped around the tube of the secondary and through the interior of the primary

secondary than copper to build special types, a large number of which are manufactured by the company.

The dynamo, Fig. 2, is compound wound under patents the property of the company, is believed to be as, or more, efficient than any other alternate current dynamo ever made, and is the result of experiment, conducted by Prof. Thomson and Mr. Lemp. Special attention was given to the rapid "building" of the fields, a feature not necessary in dy-

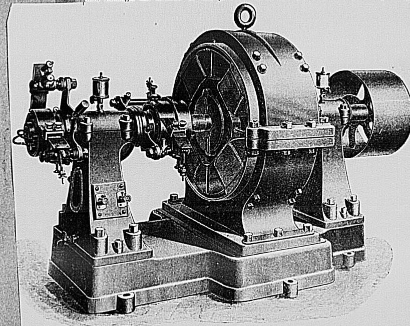


Fig. 2.—Dynamo of the Thomson Electric Welding Co.

coils. The only active portion of the secondary or welding circuit is this copper tube. The conductors from this to the clamps are very short and of large sections, thereby obviating any heating due to resistance. One jaw is fixed, the other movable, has sliding contact on the rod supporting the clamp or on the bedplate of the clamp itself. In some cases flexible conductors have been used attached to clamps placed in guide beds. The general compactness may be seen at a

namos for electric lighting. The machine work, at once durable, exact, and beautiful in design and finish, is done entirely by skilled mechanics, of whom over 100 are at present employed in the factory. Besides the dynamo illustrated, other types are made, in some cases of bipolar construction. The range of work that can be done by these machines includes the finest watch and steam engine construction. The machine is self contained, and self exciting, the commutator for which is outside of the bearings.

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2485

July 24th — /89

EDISON SAYS IT WILL KILL.

THE WIZARD TESTIFIES AS AN EXPERT IN THE KEMMLER CASE.

He Thinks an Artificial Current Can Be Generated Which Will Produce Death Instantly and Painlessly in Every Case --One Thousand Volts of an Alternating Current Would Be Sufficient.

Thomas A. Edison was the principal witness in the Kemmler case yesterday, and he proved a sufficient attraction to fill with spectators W. Bourke Cockran's law offices in the Equitable Building, where Referee Becker is conducting the hearing to determine the merits of electricity as an instantaneous and painless means of execution. Deputy Attorney-General Poste conducted the examination, and Mr. Cockran put the witness through a rigid cross-examination without shaking his assertion that executions with the aid of the alternating, or an intermittent, continuous current are feasible in the present state of science.

"What is your calling or profession?" Mr. Poste asked.

"Inventor," briefly replied the witness.

"Have you devoted a great deal of attention to the subject of electricity?"

"Yes."

"How long have you been engaged in the work of an inventor or electrician?"

"Twenty-six years." In reply to questions he said he was familiar with the various dynamos and their construction and that they all generated either a continuous or an alternating current.

"A continuous current," he said, "is one that flows like water through a pipe. An alternating current is the same as if the same body of water was allowed to flow through the pipe in one direction for a given time and then its direction reversed for a given time."

The witness said he had been present when measurements were made in his laboratory to determine the resistance of human beings. Two hundred and fifty persons were measured, and their average resistance was 1,000 ohms, the highest being 1,800 ohms and the lowest 600.

"Will you describe the method of the application of your tests?" Mr. Poste asked.

"We took two battery jars about seven inches in diameter and ten inches high and put in each jar a plate of copper. In the jar we put water with a 10 per cent. solution of caustic potash. The parties we measured plunged their hands into the liquid so that the ends of their fingers touched the bottom of the jars. After waiting thirty seconds the measurement was taken. No one could go above eight volts."

"Where, in your opinion, is the major part of the resistance located?" Mr. Poste asked.

"I should say 15 per cent. at the point of contact. The balance in the body."

"What is the law that governs the passage of an electric current, when several paths of varying resistance are offered to it?"

"It divides in proportion to the resistance encountered."

"Please explain the burning effects sometimes produced in the case of contact with an electric wire."

"It is due to bad contact, and the difference in resistance between the wire and the flesh."

The witness denied that Harold P. Brown was in any way connected with him or any of his companies.

"In your judgment can an artificial electric current be generated and applied in such a manner as to produce death in human beings in every case?"

"Yes."

"Instantly?"

"Yes." He advised placing the culprit's hands in a jar of water diluted with caustic potash and connecting the electrodes therewith, and he said 1,000 volts of alternating current would surely produce painless death instantaneously. He did not think so small a continuous current would, although by mechanically intermitting the continuous current it could be made very deadly.

Mr. Cockran in his cross-examination laid much stress upon Mr. Edison's views as to the resistance of human beings.

"Did you make the experiments on men which you have mentioned with a view to ascertaining just how to measure the resistance of Kemmler and find out how men may differ in the matter of resistance?" asked Mr. Cockran.

"I did. I made the experiments day before yesterday," Mr. Edison replied.

"And you found out there were different degrees of resistance in different men?"

"Yes; but that does not mean that the same current would not kill all the men."

"What would be the effect of the current on Kemmler in case the current was applied for five or six minutes? Would he not be carbonized?"

"No, he would be mummyized. All the water in his body would evaporate in five or six minutes."

With what he had found to be the average resistance of the human body, the witness said that 1,000 volts would give a man an ampere of current which is ten times as much as any man needs to kill him. The witness denied that he ever gave Harold P. Brown a letter of recommendation. Mr. Brown applied to him for permission to make some experiments and he granted it, and that was all the relations existing between them. In reply to a question by the referee he said there was an alternating dynamo in London that generated a 10,000 volt current, and he considered it safe to double up dynamos to increase the current for use in executions.

"This is your belief, not from knowledge?" Mr. Cockran asked.

"From belief. I never killed anybody," the witness quietly replied.

Mr. Cockran gave the "wizard" a light for a cigar stump he had been chewing and dismissed him.

Arthur E. Kennelly, one of Mr. Edison's electricians, was the next witness. He testified that he conducted the measurements in resistance of which Mr. Edison had spoken.

On cross-examination by Mr. Cockran the witness said the amount of current that could be sent through a human body was purely experimental, not having been proven. He believed a man could be killed without burning the body, but acknowledged that the belief was based solely on their success in killing dogs. He had never heard of a man being killed by electricity who was not burned.

"What would be the effect of a dynamo current that did not kill if applied for a long time?" Mr. Cockran asked.

"How can I say without seeing it done?" the witness inquired.

"That's just what we have got back to. That's all," the attorney responded.

After Mr. Poste had asked some unimportant questions, Mr. Cockran got an admission from the witness that he would not like to be around when the speed of a Westinghouse dynamo was increased above 2,000 evolutions a minute.

GEORGE WESTINGHOUSE ON FUEL GAS.

The Great Inventor Declares That the Gas Age Has Really Come—Both How and Why.

Oct 28 — 89

To the Editor of The Evening Sun—*Sir:* Your editorial notice concerning the fuel gas problem, in which you give me credit for a very valuable discovery, prompts me to ask for some of your valuable space.

A company with which I am connected, the Fuel-Gas and Electric Engineering Company, Limited, has devoted about three years to the heating gas problem. The investigations have been carried sufficiently far to show that a new process for the manufacture of gas is not needed to bring its use for heating purposes within the reach of the many. Instead of the energies of the company referred to having been devoted wholly to processes for the manufacture of gas, the greatest attention has been given to the development of appliances for the use of gas, and already many devices have been perfected having such efficiency that their use in connection with ordinary illuminating gas will, when taking into consideration the saving in labor, dust and dirt, prove economical as compared with coal.

In the near future, when the illuminating gas companies make it a business to introduce economical devices for the burning of gas, it may be expected that the citizens of New York and other large cities will use gas very largely for cooking and other domestic purposes.

There is a simple device for the heating of water that ought to be in every household. By lighting a gas jet and turning on the water at the same time, water is boiled in about fifty seconds, and will run continuously at the boiling point at the rate of seventy gallons, with a consumption of about fifty cubic feet of gas per hour. There are roasting devices, wherein the radiant heat of the gas is reflected upon the meats to be roasted, and the result is a saving of from ten to fifteen per cent. in the weight of the meat, which is lost by the present method.

Heated air prefers the top of the room, and thus leads to the consumption of a large amount of fuel in order to get a small amount of heat upon the floor, where it is most needed. A European invention is so designed and arranged that about 50 per cent. of the heat is reflected upon the floor, so that at a distance of ten to twenty feet from one of these contrivances set in an ordinary fireplace, the heat can be readily noticed upon the floor. Not only is the heat reflected upon the floor, but the heat in the products of combustion is utilized in warming the air in the room, which it puts in circulation. So economical is this stove that about 35 per cent. of the entire heat units contained in the gas are made available, as against 10 per cent. from coal grate fires. In all bedrooms and for heating in moderately cool weather stoves of this character, from a sanitary point of view, would be worth their weight in gold, for in one minute after lighting the gas jets the reflected heat may be felt upon the floor.

In Europe, where a very careful investigation has been made in the interests of the company referred to, innumerable devices were found, of more or less merit, and which were being largely introduced because of the economical results, among a people who of necessity regard expenditures much more closely than the people of this country. It is known to a fraction of a foot how many cubic feet of gas are needed to broil a steak, to cook a bunch of asparagus, to boil a cabbage and to roast a pound of beef.

So soon as the people of New York and other large cities understand what has been done, and are able to secure the necessary appliances, they will believe that the gas age has really come.

The present cost of manufactured gas is largely due to the great percentage of leakage, and the comparatively small quantity of gas transported for an average of twenty hours per day. When a large quantity of gas is used for heating during all hours there will be no special need for a better process of manufacturing gas than the present, for the greatly increased consumption will lessen the price, and that, in connection with the economical appliances, will bring what is truly a great luxury within the reach of all classes. However, the importance of the manufacture of a cheap fuel gas is more fully recognized now than ever before, and there are hundreds of gas engineers to-day working on the problem, and there is every reason to expect that most excellent results will follow such persistent labors. The work begun three years ago on this subject is still being followed by people in my interests, though it is made of secondary importance at the present time, the first importance being given to the development of appliances for burning gas economically.

George Westinghouse, Jr.

Pittsburg, Oct 24, 1889.

THE WAY TO SAFETY.

First—There is no known method of practically insulating overhead wires under the present conditions of plant.

Second—Putting wires underground in tubes through which the air passes, and subject to condensation of moisture and ingress of water, to the dissolving action of coal gas and air oxidation, *will transfer the deaths to the manhole, the stores and houses.*

Third—There is only one method whereby all dangers can be eliminated, and I think perhaps, under the law governing police regulation of municipalities, the police could carry it out, and that is to limit the electric pressure and its character down to or below the point of danger to life, just as a boiler in New York has to be tested by the police and the pressure valve set before it can be used.

Fourth. The maximum pressure allowable for continuous currents is in my opinion seven hundred volts, with but five volts maximum pressure between any two consecutive blocks of the machine generating the current and two hundred volts pressure for the alternating current.

The change necessary to carry this out, say in the case of the Brush Company, would be *doubling the diameter of the copper wire* they now use and the use of properly commutated machines. If the latter were substituted, it would make an additional expense for copper of $500 per mile.

Oct 13 1889?   Thomas A. Edison.

lessen their dividends; but the dividends of electric-light companies are not generally esteemed to be matters of an absolutely sacred character. Whatever the Directors of the companies may think, there is still a popular conviction that the right of the citizen to remain alive and in reasonable safety is superior to any man's claim upon the public for large dividends from a monopoly.

Thomas A. Edison asserts that there is no insulation which will make an electric wire safe, either above or below ground. He says that high-tension underground wires will burn out the tubes and may force dangerous currents into houses and manholes. Herein is suggested a more unpleasant possibility than lurks in the overhead wires. Mr. Edison is right in his position that electric tension should be regulated by law. The only reasonable solution of the whole problem lies in making every electric wire safe, not because it is insulated, but because in its nakedness it carries no death-dealing power.

Oct 13 1889?

MECHANICAL REVOLUTION.

A Remark Made by Villard Causes Much Discussion.

NEW YORK, July 12.—Electricians and railroad men have been discussing the remark said to have been made by Henry Villard just before he sailed for Europe, that it would be well to go cautiously in respect to certain expenditures for locomotives, because it was probable that within a few years the motive power of every railway in the United States would be changed. Another report has it that he was approached by men interested in the development of a new electrical discovery, and when he had examined it he declared: "We are on the eve of a great mechanical and industrial revolution, so great, in fact, as to do away practically with steam as a manufacturing and motive power."

Some of Villard's friends say that his attention has been directed recently to a discovery made by a New York young man, by which stored heat of coal may be developed in power without the intermediary of a furnace, boiler or steam engine. If this is true the young man has outstripped Edison, for he has made a discovery which Edison has for years sought to make, and which, upon two or three occasions, he thought he had made. Edison himself has authority for saying that if this secret should be revealed it would be followed by a revolution in the mechanical industry equal to or greater than that which came upon the heels of Watts' discovery and invention of steam power.

...been stated, to de...

MR. EDISON OFF FOR EUROPE

A VISIT FOR PLEASURE TO THE CONTINENT—HE WILL NOT GO TO ENGLAND.

Among the passengers who started for Europe yesterday was Thomas A. Edison, the electrician. Considerable mystery surrounded his departure. His name did not appear on the official passenger list of the steamer La Bourgogne, which carried him to Europe. His tickets were purchased in the name of his private secretary, Samuel Insull, and wife, as Mrs. Edison accompanied him. At his own office in this city, nothing was known of Mr. Edison's intentions on Friday evening, and even an hour before the boat's departure the employes were uncertain whether their chief was bound for foreign shores. However, a reporter of The Tribune had little trouble in finding Mr. Edison on board the French steamer early yesterday morning. Chatting with Bishop Littlejohn, of Brooklyn, and other friends who were in his party, he seemed to have little fear of seasickness or any disagreeable weather.

Mr. Edison chose a French vessel for the journey because he did not desire to touch England, having an aversion to the land of Albion. It is only one of his whims, but so strong that it is still doubtful if he will visit London when homeward bound, despite the great interests which call him there.

The trip, said Mr. Edison, was to be one of pleasure almost entirely. He will be gone between two and three months, spending the greater part of his time in Paris, Berlin, and in Switzerland. Naturally, the Exposition will take up much of his time in the gay city, as it contains the largest electrical exhibition ever presented to the public, as well as the largest collection of Mr. Edison's patents, which naturally form the greater part. Mr. Edison has never seen a full collection of his patents at one time and, as he said, his own collection will be a subject of interest to him for that reason.

When it became known in Europe, where the inventor has hosts of friends, that he intended to visit the Continent, invitations were fairly showered upon him from persons of all kinds and classes, officials and non-officials, societies and unions. Receptions will be proposed for him in the French capital and other cities, despite the fact that he declined them all. He will remain, however, in Paris, according to his present plans, which circumstances may change, until the beginning of September, when he will go to Berlin.

While in the German capital he will be the guest of his friend and fellow inventor, Dr. Wehner Liemens, who is almost as famous as Mr. Edison himself. Much time will be devoted to investigation of the Liemens laboratories in Berlin and Charlottenburg, a suburb of Berlin. The Edison Company of Berlin will also welcome its chief.

This is Mr. Edison's first visit to the continent of Europe. He spent some time in London in 1872, but did not leave the city, which he is now anxious to avoid, to cross the Channel.

He will, doubtless, be welcomed cordially by the President of the French Republic, as, in addition to his fame as an inventor, he is also a member of the Legion of Honor, having received its decoration in 1882. It is possible that he will meet the Shah in Paris, and have an opportunity to explain personally the mysteries of the phonograph, in which His Imperial Majesty is so much interested.

A pleasant farewell dinner to Mr. and Mrs. Edison and Mr. and Mrs. Francis R. Upton was given on Thursday evening by Mr. and Mrs. Everett Frazar, of High-st., Orange. Eighteen covers were laid.

August 4th/89

McCrum

Paris and London, Twenty Centimes (2d).
Elsewhere, Twenty-five Centimes (2½d).

AT THE EXHIBITION

All the Nations of the World Astonished by Edison's Phonograph.

MORE DEVELOPMENTS PROMISED

Interesting Experiments Before the Electrical Section of the Jury.

HOW THE RESULTS ARE OBTAINED

Galignani's Messenger

[THIRTY-FIFTH ARTICLE.*]

No feature of the Paris Exhibition attracts more general attention or awakens greater interest than that wonderful invention of Edison's the phonograph or talking machine. To the student of human nature no spot in the Exhibition affords better opportunities for the exercise and development of his talents than about the Edison phonograph pavilion in the Palais des Machines or in the pavilion in the industrial section of the United States. It is interesting to watch the various expressions of interest, curiosity, amazement, delight, and even fear which come over the faces of the listeners surrounding the phonograph each with the flexible listening tubes held to his or her ears.

A COSMOPOLITAN GROUP.

Here you may see shoulder to shoulder the French Academician, the journalist, the labourer, the donkey boys from Cairo, King Dinah's followers, in fact, the most cosmopolitan gathering in the Exhibition. When Red Shirt and the other chiefs from Buffalo Bill's Camp heard their own voices they were filled with superstitious fear of Edison's wonderful invention. But the Congo chiefs, who accompanied M. De Brazza, the famous African explorer, in his recent visit with the Prince of Monaco, were differently affected: they shouted, gesticulated, laughed and jabbered, and it was difficult to get them away from the instrument.

THE PHONOGRAPH IN THE CONGO.

M. De Brazza stated that there were five distinct languages represented among these Congo people, and he considered the employment of the phonograph of enormous importance among them, as many of the tribes have a language which can be spoken but not written, there being no alphabet.

NEW APPLICATIONS.

The phonograph, although a marvellous discovery from a scientific standpoint, has too much virtue in it not to meet with enormous practical applications, and every day now applications are being found for it. In the Edison department may be seen letters written by type-writer from phonographic dictation; here also may be seen the wonderful Thorne type-setting and distributing machine, which does the work of half a dozen compositors, the matter set up by the operator being dictated to him by Edison's phonograph. For taking down interviews, speeches, recording musical or, in fact, any sounds. The phonograph does its work to perfection, and it often astonishes people by the perfect facility with which this remarkable piece of mechanism will rattle off any language spoken upon or into it. At the Exhibition may be seen tiny wax cylinders with a dozen or more languages upon their few inches of surface, and while the talking is perfectly distinct, the tracings or indentations of the tiny recording needle upon the wax cylinder are scarcely perceptible. In the Edison department are cylinders containing letters sent by Mr. Edison from his laboratory at Llewellyn Park, Orange, New Jersey; cylinders of the voices of President Carnot, Charles Gounod, Savorgnan De Brazza, the Prince of Monaco, and many others of distinction.

FURTHER DEVELOPMENTS HINTED AT.

One of the most promising fields for the employment of the phonograph is undoubtedly in connection with telephony, and we shall in the near future be able to call up a friend even in a distant city, and, if not in, leave a message in our own voices upon his phonograph. It is to-day only possible to telephone a few hundred miles, but, by employing the phonograph as a relay, and by using Edison's loud-speaking motograph telephone, we can record the messages upon the phonograph, and then transmit them to a far greater distance than is now possible by the employment of the telephone alone. The most remarkable experiment of this character ever made has been conducted by Mr. Wm. J. Hammer, who represents Mr. Edison's interests at the Paris Exhibition. Music, singing, and talking were transmitted by a phonograph through a telephone circuit from New York to Philadelphia, a distance of 103 miles (six of which were underground), where the sounds were recorded upon another phonograph, which again spoke or sent them through a telephone circuit, so that the audience at the other end of the line heard it plainly. This experiment was made with instruments all of Mr. Edison's invention, i.e., two Edison phonographs, two Edison carbon telephone transmitters, two Edison motograph receivers, two sets of induction coils and batteries, and 103 miles of long-distance telephone wire. Mr. Edison was also the first to apply the induction coil to the transmission of audible speech.

RECENT EXPERIMENTS.

Some very interesting experiments with the phonograph were made last week by Mr. Hammer at the residence of M. Louis Rau, Director of the Compagnie Continentale Edison, in the Rue Montchanin, the occasion being an informal gathering of the electrical section of the jury of which M. Rau is a member. His beautiful home is lit with the Edison incandescent light, and is connected with the Opera by telephone, and upon the evening in question the guests listened also to the music, talking, singing, and bugle calls transmitted by an Edison phonograph, miles away, in the Edison Pavilion Palais des Machines, which was sent through the telephone across the city.

AN ORIGINAL EXPERIMENT.

A remarkable and original experiment was also shown, in which some singing, talking, and other sounds made upon one-half of a cylinder of a phonograph situated in the parlour was sent through a telephone line to a phonograph upstairs, where it was recorded

2496

Edison Lionized in Berlin.

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[SPECIAL CABLE DESPATCH TO THE WORLD.]

BERLIN, Sept. 15.—Edison is as much lionized here as he was at Paris. He is the guest of Herr Werner Siemens. Many distinguished scientists are away from the city, but all those in town went last Friday to the reception, saw the phonograph and heard the instrument reel off Paulus's famous Boulanger song and the applause of the crowd as distinctly as it was heard in Paris. Edison has started for Heidelberg for the meeting of the Scientistst Association there. When he comes back he will exhibit the phonograph to Emperor William, Prince Bismarck and Count Von Moltke.

2497

Edison to Visit Krupp's Works.

PARIS, Aug. 20.—Mr. Edison, the famous American electrician, will visit the Krupp works at Essen, Germany, before the termination of his visit. He will return to America by way of England.

ENTERTAINED BY "BUFFALO BILL."

Paris, Aug. 27.—Colonel William F. Cody, "Buffalo Bill," to-day gave a breakfast to a number of prominent Americans now in Paris, including Mr. Edison and party, John Hoey, Chauncey M. Depew, Michael O'Brien, Augustin Daly, Miss Ada Rehan and party, Colonel Moore and T. P. Branch, of Georgia. There were seventy-five ladies and gentlemen present. Mr. Whitelaw Reid, the United States Minister, and many members of the American colony were among the guests. At the Wild West Show this afternoon 6,000 spectators gave Mr. Edison an ovation.

Jan 21 1890

Edison as He Is.

[Chicago Herald's New York Letter.]

I had a good look at Edison the other day, and brought away the impression that no bust or picture conveys an adequate idea of the man. There is a singular power and sweetness in the face, and the man is altogether more massive and striking than popular portraits would lead one to suppose. His head is unusually large and the brow is broad, full and serene. The nose is large and full of character, the smooth-shaven chin and jaw are good, the mouth is wide, as it should be in a man of force, and the eye is peculiarly strong and attractive. This fine head is set on a stout neck, and below spread broad shoulders and a massive chest. In the group of distinguished men of National reputation, with whom I saw him, his was by far the most striking presence. When called upon to speak, he put in an almost boyish protestation with deprecatory smile and uplifted hands, and nothing could bring him to his feet. A clever and observant young woman recently told me of her visit to Edison's laboratory. A particularly elegant assistant moved about the room, while a man in a shabby gray coat shuffled in and sat down at a desk. This, to the young woman's surprise, proved to be Mr. Edison. The inventor had the lady's companion sing into the phonograph and listened as best he could with his defective hearing. Later he shut himself into a little room, and for an hour after there issued from that closed chamber a curious succession of vocal sounds, while the inventor experimented with his favorite invention.

...stated, to de-

ORDERED THE WIRES CUT.

THE MAYOR MET BY INJUNCTIONS, AND THE WIRES REMAIN.

A Great Public Stir Over Poor Feeks's Death—$800 for the Family Dropped Into a Tin Box Nailed to the Telegraph Pole—The Inquest to Be Thorough—No Insulation Is Safe, Thomas A. Edison Says, with High-tension Currents.

The death agony of Lineman John E. H. Feeks, high on a telegraph pole in the sight of horror-stricken thousands of citizens, has given a mighty stir to all this question of the haphazard transmission of high-tension electrical currents through a centre of population. The Mayor yesterday, as spokesman of the Board of Electrical Control, ordered all unsafe electric light circuits cut out and the currents turned off. The principal companies responded with injunctions, and a fight against the very existence of the Board of Electrical Control is ahead.

A test of the immediate public interest which has been aroused was made on the very pole on which Feeks died. A tin cracker box with a glass front was hunted up in Coogan's saloon, at 12 Centre street, and at 7 o'clock yesterday morning was nailed to the telegraph pole. Over the box was placed the inscription:

Subscriptions for the family of the unfortunate lineman who met a horrible death on this pole, Friday, Oct. 11. Subscriptions will be forwarded daily by Edward C. Coogan, 12 Centre street.

Placards were tacked to the pole on every side with the appeal, "Help the Victim's Widow" and "Don't Forget the Victim's Family."

Crowds of men and women, boys and girls were hurrying on their way to work when the box was first nailed in place. The signs attracted their attention and not one out of a dozen passed by without putting at least a penny in the box. Men and women whose dress was of the poorest came in a constant stream and dropped in money. Newsboys, bootblacks, and Italian fruit venders brought pennies and nickels. Drivers on the Madison avenue cars stopped their teams and ran to the box to drop in a dime, and many of the conductors and passengers followed the example of the front platform. In went the "pot" of a newsboy's game of craps, offered by the winner. "Put my penny in mister," said many a grimy-faced newsboy to the tall park policeman who stood guard over the box. The little girls wanted to put their money in the box themselves and the graycoat lifted them up.

Greenbacks were frequent, too, and at 1 o'clock there were $60 in bills in the box. One wad of $22 was crowded into the box by a man who had just won it in a neighboring pool room. An old apple woman, her face drawn with neuralgia, hobbled up and dropped a handful of pennies. District messenger boys rattled nickels and dimes in. In the crowd at the corner Detectives Von Gerichten, Phil Reilly, and Kiernan could not find a single crook.

At 1 o'clock Detective Robert Quackenbush of the City Hall squad opened the box, which was half full of silver and copper, and emptied it into a big bag. It took an hour to count the pile. In six hours just $399.04 had come in. John Carroll of the District Attorney's office added 96 cents to it, making it just $400. The box was replaced at 2 o'clock, and at 6 o'clock there was in it $422.23 more, making $822.23 for ten hours. The self-appointed committee was made up of Otto Heppenheimer, W. T. Moriarty, Ed C. Coogan, W. E. Morris, J. E. Brodsky, John A. Moran, and John F. Morrow.

To-day the box will go up on the pole again at 8 A. M., and again on Monday as well. The money collected yesterday will be sent to the widow to-day.

ORDERS TO CUT DANGEROUS WIRES.

Mayor Grant came down to his office at 10 o'clock sick and weak, but bound to get at the facts about the danger from the high-tension wires. He got the Board of Electrical Control together at 11:45 o'clock. A few representatives of the electrical companies stood around and reporters swarmed. The Mayor said as he took the chair:

We have only a quarter of an hour in which to do business. The legality of anything done after 12 o'clock might be questioned, as this is a half holiday.

Commissioner Gibbens—We can turn the clock back.

Mayor Grant—No. I won't do that. Here is a report of the electrical expert, which the Secretary will read unless the expert now desires to amend it. Do you, Mr. Wheeler?

Mr. Wheeler said no, and the Secretary read this report:

With relation to the notice served by the Board upon the electric lighting companies, I have to report as follows:

As I stated at the meeting of the Board yesterday (Thursday), I am unable, without a larger force than that at my disposal, at present to say which of the wires used for electric lighting is in proper condition. On the other hand, I am able to inform you that, notwithstanding the notice of the Board, two electric lighting companies have operated since the receipt of that notice wires known to be imperfectly insulated.

These companies are the Brush and the United States companies. Their stations are situated at the following places: Brush, 210 Elizabeth street; United States, 263 Fulton street, 38 Stanton street, and 416 East Twenty-ninth street. The enclosed memorandum shows that certain of their wires specified therein are improperly insulated, and constructed contrary to the rules and regulations of the Board.

Mayor Grant (to Expert Wheeler)—Do you believe that those two companies are the only ones whose wires are dangerous?

Mr. Wheeler—Oh, no, but they maintain nineteen-twentieths of them, and the dangerous wires that I have been so far able to find in the limited time I have had are theirs.

Mayor Grant—Are the recent deaths chargeable to their wires?

Mr. Wheeler—Yes.

[...] struction, said, "Service will be made as soon as copies are prepared. Here is the original."

The paper was a temporary injunction granted by Judge Andrews, forbidding the Mayor, the Board, and Mr. Gilroy, and all other persons having notice of the injunction:

From compelling the current of the plaintiff to be turned off from its overhead wires in this city or any of them by virtue of any pretended authority conferred by a certain resolution adopted by the Board of Electrical Control on Oct. 9, 1889, and from removing or causing to be removed under or by virtue of the said pretended authority of said resolution or otherwise any of the overhead wires or any of the poles of this plaintiff in the city of New York, and from in any manner enforcing or attempting to enforce the said resolution, or in any way interfering with the business of the plaintiff under the pretended authority of the said resolution or otherwise.

Cause must be shown before Judge Andrews on Monday why the injunction should not be made permanent. The orders were in behalf of the United States Company and the Brush Company only. Corporation Counsel Clark told Mr. Gilroy that he must let the wires of these companies alone. Mr. Gilroy asked Mr. Wheeler if there were dangerous wires belonging to any other company that he could designate, and he said that he could find some.

ORDERS TO SHUT OFF DANGEROUS CURRENTS.

On returning to his office Mr. Gilroy sent out to all of the electric light companies this notice:

You are hereby notified that in accordance with directions received by his Honor the Mayor this department will proceed at once, beginning this day, to remove all electric light wires in this city which are at this date improperly insulated, and are in position in violation of the rules and regulations of the Board of Electrical Control.

You are further notified to immediately shut off the electric current from all such electric light wires under your control, and that you will be held responsible for any accident or injury to person or property which may be caused by the existence of such wires.

The companies with injunctions, of course, paid no attention to this letter, and the Manhattan Company served an injunction granted by Judge Andrews. The papers had been drawn several days, and only needed a Judge's signature. Commissioner Gibbens was standing on the steps of the City Hall when the papers arrived smoking a cigarette. A representative of one of the enjoining companies touched him on the arm and told him about it.

The East River and Mount Morris companies were about all that Mr. Gilroy could touch, and the circuits controlled by these concerns are small compared with the others. The Brush and United States lines were the ones that Mr. Wheeler was aching to get at. It was decided, however, to make a raid upon bad insulation within the province left to them, and at 3 o'clock a gang of forty men started out on the work.

A FEW WIRES CUT AND MANY SPOTTED.

Contractor Hess went along with Expert Wheeler and his gang, locating badly insulated wires. They began their work at Chambers and Centre streets, right at the scene of Feek's death. They had no trouble in finding bare wires in plenty. At the northeast corner of Chambers and Centre streets all the insulation was gone from a wire for several feet. Other bare spots were found in front of 22 Centre, at Duane and Centre, and in front of 54 Centre. At these three points the wire was found to belong to the East River Company. Three men followed on the heels of the city's employees hurriedly repairing the defective spots.

Mr. Wheeler found that the two power wires belonged to the Electrical Power Company, whose station is at 83 Centre street. He said that the insulation was defective, and he ordered them cut down at once. They were brought to the ground all the way up to the station in Centre street. Mr. Wheeler pocketed several sections of the wire which showed careless insulation. The station was closed at the time and the wires were dead.

Mr. Wheeler says there is nothing to indicate that these were the wires which had carried the current to the Western Union wires and killed Feeks. Embury McLean, engineer and part owner of the company, which is not incorporated, said that its wires are strung on Western Union poles through Centre street, with branches through Chambers to West Broadway, and through Grand to the Bowery. They carry the Edison current of 220 volts only, and furnish power to Sprague motors. J. H. Vail of the Sprague Motor Company said yesterday that the company itself had no overhead wires in New York.

For to-day Mr. Wheeler has borrowed six linemen from the Western Union, who will work with his four inspectors. Two of the Western Union men will start at the Battery and work up Broadway to locate every spot in the wires which shows danger. Two others will begin at Park row and work up Centre and Chatham streets, through the Bowery to Fourteenth street, and two will investigate the wires on Fulton street from river to river. Of Mr. Wheeler's own men one is detailed to Canal street, another to Grand street, and a third to Bleecker street. All will begin work at 7 o'clock sharp in the morning and continue until 11 o'clock, when they are to report to Mr. Wheeler at the office of the Board. He expects that his men will locate defective insulations on every block. Each of them will make an affidavit, and armed with these affidavits Mr. Wheeler will go into court Monday.

WILL THE INJUNCTIONS HOLD?

The Board of Electrical Control is of the opinion that the injunctions won't hold. They base this conclusion upon section 4 of the law governing the Board. This provides that it shall be unlawful for any corporation or individual, without a special permit in writing, to maintain or string any wires above ground. The law also gives the Board the power to alter, add to, or amend the rules in a proper way, and provides that these rules may be put into effect by the Board requesting the Mayor to act.

The Manhattan Company wrote to the Mayor yesterday that they used only the best wires, and would stop their current four hours a day, if desired, for inspection of the wires. The East River people said they had got no injunction because they needed none, having no defective wires. While an official was telling this to a SUN reporter word came by telephone that Mr. Wheeler was cutting the company's wires on Centre street. [...]

[...] safe. When under ground the high tension wires will burn out the fibres, the dangerous current will creep into your houses, and will come up the manholes. There is one way, and only one, in my opinion; that is, to regulate the tension under similar police regulations to those governing the pressure on steam boilers.

"For example, one single shock of a 500-volt pressure would hardly affect a man closing the current between two dangerous wires. You can increase the tension to 800 volts with accommodating blocks at five volts between, and while such a pressure might injure, it would not kill. It would probably give simply a strong nervous shock, but, as for insulation, there is no insulation in the world which will remove the danger.

"The greatest caution cannot prevent a human being from occasionally closing the current. Perhaps yesterday the wires crossed in Harlem. A porter sweeping out some office can form a connecting link which will leave him dead, and, as I say, the subway will only be a question of burnt-out tubes and of deadly accidents, perhaps less occasional. The only solution is to restrain the tension of the current, as I have said, exactly as the pressure on a boiler is regulated."

"Do you suppose that the man yesterday felt any pain?" asked the reporter.

"It is doubtful. Probably not."

"By the way," said the inventor, with some show of anger upon his broad brow, "it was one of the things which always made me hopping mad to think of the pirates in the electric business, not merely stealing the radical invention which made the lamp possible, but taking advantage gratis of the long line of thousands of experiments which I had made night and day for a couple of years. At the same time there went on experiments for cheapening the machinery to manufacture all parts of the lamp. You see we had, as we nearly always have, the necessity of inventing the very tools to use, as well as the machines of manufacture, every one of them taking time and costing money."

"I observe that you no longer use the electro-plate welding for joining the carbon to the platinum?"

"No. That is funny. We began with the very first lamp by using a simple paste. Now, after years of experimenting, we have gone back to paste.

"But," he added, with a slight twin- [...]

[...] improvement within the last two weeks—regulating the automatic feed of the rollers in the mill—which will save thousands annually in repair and save the labor of twenty-five men.

"This is a great business. It illustrates what I mean by beginning at the large end of things. The main invention has been before the world for ten years. The iron and steel men who looked at it immediately pooh-poohed it. When I showed them the pure magnetic oxide in fine powder produced by my process they said it was very good ore, but it could never be worked, as it would blow out of the furnaces and produce plenty of dust, but no iron. I went through a great deal of searching and experimenting to find the proper place to begin. My attention was first drawn to large deposits of sea sand off the coast of Long Island—sand rich in magnetic iron. The specimens produced by working it were splendid. Then came the damper from the iron men. The thing lay unattended to for three or four years.

A SHIFTING EMPIRE.

"When I took the iron idea up again I sent out prospectors over the same [...]

been so far able to find in the limited time I have had are theirs.

Mayor Grant—Are the recent deaths chargeable to their wires?

Mr. Wheeler—Yes.

Mayor Grant—Then Tuesday's case (Charles Erdman, at Grand and Elm streets) has not been called to your attention?

Mr. Wheeler—Yes, I have investigated it, and I think that a Brush wire was the cause of death.

Mayor Grant—I think the Coroner's jury will find differently. I propose to give orders to the Commissioner of Public Works that all wires not properly insulated be promptly cut down.

Commissioner Hess—That's the only way.

Mayor Grant—I do not wish to have any two particular companies designated as in this report, but to have the dangerous wires attacked as they are come to. I will also offer a resolution that the engineer of this Board be directed to be prepared on Monday to offer us a plan for a comprehensive system of subways to cover as much of the city as possible.

Commissioner Moss—You mean electric light subways.

Mayor Grant—Yes, before all else. The others can wait. Their wires are a disfigurement, not a danger.

"Mr. Gilroy," called the Mayor, raising his voice. The Commissioner of Public Works appeared from behind a desk with a law book in his hand. The Mayor turned to him after a glance at the clock, and said: "There is no time to draft an order in specific terms, but I now direct you to cut down and remove such electric light wires as have been operated in violation of the law and the rules of this Board."

"Hadn't the designation of the wires better be included in the order?" asked Mr. Gilroy.

"The expert of the Board will designate the wires," the Mayor responded.

INJUNCTIONS SERVED AT ONCE.

The attending electric light people scurried out with the news and Mayor Grant asked:

"What can be done to give help to the expert? He says that he has not yet inspectors enough?"

Commissioner Gibbens—Ordinarily we have to get them through the State Civil Service Board, but in this emergency men can be employed for thirty days without examination.

A resolution was adopted giving Mr. Wheeler power to hire assistance. Mr. Wheeler suggested that the cutting down of live wires was dangerous and that notice be given to the companies to shut off their currents.

Everybody, including Mayor Grant, said "certainly." Commissioner Gilroy asked when Mr. Wheeler would be ready.

"I am ready now," said Mr. Wheeler.

As to Feeks's death, Mr. Wheeler said he had examined the pole and wires. They were principally telegraph and telephone wires on the pole, with two wires of an electric power company. He had visited the power company plant and found that their current as generated by an Edison dynamo was not dangerous to life. But he found that there was a loop of the United States Illuminating Company's wire within half a stretch of the pole, and thought it very likely that the wire that Feeks was handling may have sagged and crossed it.

Mayor Grant inquired sharply how the power wires got on that pole. Mr. Wheeler did not know whether there were permits for them or whether they were strung before the permit system. The tangle of the wires, caused by cutting them to get the body down, together with the lack of time, had prevented him from thoroughly investigating the matter. The Mayor thought it strange that so much information should have come to him and so little to the expert, and said: "I expect a fuller report of you. This is not satisfactory. If you are pressed for time you must get help."

Mr. Wheeler—I do not consider it a satisfactory report. In fact, I have made no report as yet. There were wires of different companies and classes on this pole, and that is a thing I have fought against for a year.

The Board adjourned to Monday at 11 A. M. The members were just rising from their seats, when Commissioner Gilroy rushed into the room in a state of considerable excitement and said: "I am notified that an injunction order has been issued. (To the Corporation Counsel)—I would like to ask whether that is a sufficient service or whether I can go on."

Tredwell Cleveland of Evarts, Choate & Beaman, who had intercepted Mr. Gilroy in the corridor on his way to begin the work of de-

this to a SUN reporter word came by telephone that Mr. Wheeler was cutting the company's wires on Centre street.

It was learned yesterday that there is over 200 miles of what is called underwriters' wire in use in this city on electric light circuits. It consists of a copper core covered thinly with white lead, which is then bound with tape. When dry this insulation is fair, but when wet it is worthless. This is the wire which the linemen call "undertakers' wire." Both the United States and the Brush companies use it, Commissioner Moss says.

Mr. Moss asked yesterday of Mr. A. F. Mason, a Boston electrician who was in town: "Would you be willing to take hold of two insulated wires of any sort which held high tension currents?"

"No, sir," said Mr. Mason promptly. "There is no perfect insulation. Some insulations are better than others, that is all. Some insulations are so good that there would be practically no danger in handling them when perfectly new, but no insulation has been made or can be made that will withstand the weather and rubbing against other strung wires very long. And even if the insulation was perfect, it would not prevent induction. High tension currents can be inducted into dead wires from insulated as well as from uninsulated wires."

FEEKS'S CORPSE CARRIED HOME TO HIS WIFE.

It was not until nearly 4 o'clock in the afternoon that the lineman's corpse was carried up the steps of the little frame house 58 East 129th street, where he had lived. Mrs. Feeks, calm and collected, hushed her baby in the basement sitting room. She had been informed of her husband's death at about 6½ the night before by her physician, Dr. J. H. Demarest.

She was sitting in a rocking chair, awaiting her husband, and with a smile she asked the Doctor whether he had come home yet. When told in the gentlest manner of his death she sank back stunned and dazed. It was two hours before she could cry. She is about to become a mother again, and the Doctor is anxious about her. Mrs. Feeks is the daughter of James Tucker, a gasfitter. Her eldest child is a little girl of eight years, daughter of her former husband, George E. Goll, and Lineman Feeks's girl baby is 22 months old. Feeks was married on March 13, 1887. He was a member of Gettys Lodge of Odd Fellows. The funeral will be at the house to-morrow evening at 8. The burial will be at Woodlawn on Tuesday at 10½. Mrs. Feeks and her children were dependent on her husband alone for support, and they are left with almost nothing besides the lodge insurance.

Before Feeks's corpse was taken home to his wife Deputy Coroner Weston had made an autopsy at 69 East 125th street. Coroner Schultze, Deputy Coroner Jenkins, and Drs. Demarest, O. A. Tinker, H. P. Shaw, Williams, and McLean and Prof. Biggs of the Carnegie Laboratory were present. The face of the dead man was a shocking sight. A wire had burned into the neck below the Adam's apple, nearly severing the œsophagus, the under lip was burned away, the right side of the nose was burned, and the right cheek and ear were gashed. As in all cases of death from electricity, evidences of asphyxiation were found. It is the result of death by shock. The blood was very thin, a condition usually observed in cases of death from electric shock. The sole of the left foot was badly burned, and the middle finger of the blackened right hand was nearly severed. This showed the course the electric current took. Coroner Schultze will summon a jury of eminent New Yorkers and hold the inquest in one of the court rooms of the City Hall some day this week.

WHAT EDISON SAYS.

No Insulation will Make a High Tension Electric Wire Safe.

Interview with Edison in the Evening Sun.

"You read of the accident to the lineman yesterday?"

"Yes. It was peculiarly horrible, but the subway will not solve the problem. There is no insulation which will make an electric wire

"By the way," said the inventor, with some show of anger upon his broad brow, "it was one of the things which always made me hopping mad to think of the pirates in the electric business, not merely stealing the radical invention which made the lamp possible, but taking advantage gratis of the long line of thousands of experiments which I had made night and day for a couple of years. At the same time there went on experiments for cheapening the machinery to manufacture all parts of the lamp. You see we had, as we nearly always have, the necessity of inventing the very tools to use, as well as the machines of manufacture, every one of them taking time and costing money."

"I observe that you no longer use the electro-plate welding for joining the carbon to the platinum?"

"No. That is funny. We began with the very first lamp by using a simple paste. Now, after years of experimenting, we have gone back to paste.

"But," he added, with a slight twin-

improvement within the last two weeks—regulating the automatic feed of the rollers in the mill—which will save thousands annually in repair and save the labor of twenty-five men.

"This is a great business. It illustrates what I mean by beginning at the large end of things. The main invention has been before the world for ten years. The iron and steel men who looked at it immediately pooh-poohed it. When I showed them the pure magnetic oxide in fine powder produced by my process they said it was very good ore, but it could never be worked, as it would blow out of the furnace and produce plenty of dust, but no iron. I went through a great deal of searching and experimenting to find the proper place to begin. My attention was first drawn to large deposits of sea sand off the coast of Long Island—sand rich in magnetic iron. The specimens produced by working it were splendid. Then came the damper from the iron men. The thing lay unattended to for three or four years.

A SHIFTING EMPIRE.

"When I took the iron idea up again I sent out prospectors over the same

MORNING JOURNAL:
PAGES 17 TO 20.

SUNDAY, JULY 2, 1891.

A DAY WITH EDISON.

The Genius of Electric Light.
(From the marble statue in Edison's library.)

A Long Chat with the Most Interesting Man in the World.

'THE LARGE END OF THINGS.'

Some of the Secrets of His Great Success in Life.

of work; Edison in the face of one of his gigantic achievements.

He had been talking in his luminous, stimulating way with the JOURNAL reporter, and the talk, partly led by inquiry and partly drifting, had gone over many of the topics near and dear to him. He had risen from his easy chair on the piazza of the little white-painted, two-story cottage at Ogden, in the shaggy, rocky and hilly northern end of New Jersey, where he sleeps and eats when he is overlooking his great magnetic rock crushing enterprise there. He had risen and made a sweeping gesture, showing the breadth of his chest as he did so, and the masterful light in his face as he uttered the words, "the large end of things," was worth a journey to see.

What did the words mean? They meant that in taking up a subject for investigation he preferred to view it in its widest limits of application to human life and action.

"The larger includes the smaller," he went on, "the details grow out of the principle. The small and petty are at the hands of every man to do. We are apt to be impressed by the bowlder be-

mensely rich and he found true poetry in landscape gardening.'"

Edison laughed. "Well, that way of putting it rather takes the poetry out of it; but he loved the beautiful, and he sought to realize it on a grand scale. He did not aim at the small. He pursued his object unweariedly. He went through all the drudgery necessary to reach his ideal. He sought to do rather than to be known as achieving, and Poe says of him that in a contempt of ambition he found the principle of earthly happiness. That is my idea—to work on at what best pleases me, to let the object be great enough, and when that is done with to begin with something else.

"Work that interests one is delight. If it does not call too much on the physical powers it is not exhausting, no matter how prolonged."

HOW HE WORKS.

"You don't prescribe eight hours a day for yourself."

Edison smiled and looked sidewise at his blond young secretary, Mr. A. O. Tate, who was twirling his mustache in an easy chair hard by.

"Eh, Tate?" he said, and then he laughed aloud.

The fact is that the question of his working hours is one of the amusing terrors of Edison's life. His wife, his family, his dearest friends, and occasionally the doctors are wont to implore him not to work so hard or so long. In the old Menlo Park days he used to work day and night in the laboratory on the top of the hill, snatching a bite now and then and doing with a nap of an hour or two at a time, taken on the first workman's bench that had an apron lying on it. I remember twelve years ago leaving him once when he was working on the electric lamp at 4 in the morning. He was stretched out on a bench in the machine shop with his cap over an iron block to make a pillow. He said:

"Shut the front door to keep the dogs out. I'm all right here, because the fellow that works at this bench will be here at 6 and he's not afraid to wake me, so I wont oversleep."

What sleep he got there nobody knows, but it was very little. When he took up his abode at Llewellyn Park and put up his great laboratory there, things were a little better. But Edison has his own theories on these matters. One is that difficult results are only reached by continuous concentration, and to keep doggedly at it the item of sleep must not be taken into account. It may be that he has at times carried this too far, but anyway the surest way to bring a shade of displeasure to his brow is to tell him that he is overworked. As a consequence, when he feels that way, he resumes his old habit of working at night, and has within the past few years, incredible as it may seem, worked three days and three nights at a stretch. They have a cot for him in the Llewellyn laboratory now, and they send him his meals down from his mansion in the park when he is working hard and close. Sometimes he uses the cot, and sometimes he takes a bit of the tempting dishes his wife's loving care provides; but neither avail to tempt him when he is busy with some trying problem.

"What is the best quality for a workman here?" I once asked him.

"Never to look at the clock," said he, with a grim smile.

These things passed rapidly through my mind as I gazed on Edison, the workman, his clear, gray eyes lighted up, his hand extended toward the mountain, and a firm look on the slightly contracted brow, from which his wide-brimmed straw hat had been pushed carelessly back. He was in his shirt sleeves and wore a low-cut vest and dark trousers over a silk and cotton Summer shirt, with a low turned-down collar and a dark tie knotted at the throat.

WHY WE SLEEP.

He sat down again and said: "What is sleep?"

Then answering his own question, he went on: "Sleep is only relaxation of the muscles and the nerves. Do you know I have a curious thought that man wants to sleep simply because the world goes round in twenty-four hours? In the old times before man had any artificial light he had perforce to go to sleep when the sun went down. I am morally certain that if we had artificial light in sufficiency for, say a million of years, man would never sleep at all."

"Then you still keep up your nocturnal habits and defy the power of sleep?"

"I am serious about what I say," he answered. "Now see here. I came to

to steal his inventions. In my case, with a rich company at my back with plenty of means, it resulted as you know, but picture a poor inventor with his inventions in the clutch of pirates like those whom the decision of Judge Wallace so denounced."

"Did this knowledge of the patent law have any effect in directing your energies away from electricity?"

"It would take wild horses to take me away from electricity, but I did feel for a long time that my energies could be most profitably directed to the study of what may be called trade secrets rather than seeking discoveries whose protection involved patent rights."

"Then this decision really cheers you as an inventor as well as a property-owner?"

"As I said before, it makes me feel that I am not working to be robbed by others. By the way, I would like to correct an idea that seems to be pretty generally held that I make my money out of patents. That is not a fact. I make my money out of manufactures, not out of patents, although the pro-

"Solid work must be the basis."

cesses may be founded upon discoveries which I have patented."

LIGHT WITHOUT HEAT.

"What is the future of electric lighting?"

"That is a very wide and far-reaching question, but it is easily divisible into the immediate future and the great future. I would say that the immediate future lies in the spread of the present means of electric lighting gradually improving in production, economy and duration."

"Have you examined into the matters now being written about in many directions on the possibility of producing light from electricity without heat?"

"I have."

"I specially mean with reference to discoveries in the line taken up by Nikola Tesla, for instance, wherein by increasing the alternations up to twenty thousand a second light might be produced without heat."

"Yes, it has long been a problem in the electric world, but it is surrounded by difficulties. Tesla worked for me in New York.

"He was brought over from Paris by Batchellor, my assistant. He has made no new discovery, but has shown considerable ingenuity in increasing vibrations. He gets his results from the inductive coil and the Geissler tube. One

find choice of objects before you. Lured by an apparently smooth road you are led into pitfall after pitfall. The majority of men, in seeking to solve difficult problems, work on a wrong principle for years. Success most frequently lies in the direction of the most difficult and unpromising path. In other words, the searcher generally rejects the right principle. You may set it down that electric light without heat will get somehow."

LONG-LIVED LAMPS.

"Then I suppose electric light without heat belongs to what we call the great future. What will be the light in the immediate future?"

"I should say it is an improvement in the development of the incandescent light. Experiments will proceed in the direction, for instance of larger lamps, of smaller lamps and of lamps with longer life. Probably what might be called the type lamp has definitely been decided on, as that of sixteen candle-power which you now see everywhere. Much can be done to lengthen the life of the lamp."

"How is that?"

"By a finer adjustment of current force to the bearing power of the carbon."

"Do you think that anything approaching a permanent lamp is possible with the incandescent light?"

"There is nothing permanent in this world, but when I speak of increasing the life of the lamp I mean making a lamp that will see a ripe old age. Some people would call it permanent."

CHEAPER LIGHT.

"In what other direction will improvements be made?"

"The greatest and most important, far transcending the matter of the life of the lamp, is that which relates to the amount of lighting obtainable per horse-power. The advance in this line has already been extraordinary. At the beginning, when I first invented the lamp, the utmost we could get per horse-power was six lamps, sixteen candle-power. After a while we raised it to eight, a little later to ten, then to twelve and finally, by degrees, to fifteen. Every step in increasing the number of lamps per horse-power is attended with greater and greater difficulty, but I have no doubt that ultimately the product per horse-power

must do away with the great investment necessary at present."

UNIQUE CARBON.

"On the point of the length of the life of a lamp, I have been told that experiments have been made of applying certain salts to the carbon, the crystals of these salts acting as a sort of sheath to the carbon, and so tending to prevent its destruction."

"Yes, many such experiments have been made, and I have made a great many myself, but the trouble is that everything I have applied to the carbon externally flies off when the carbon becomes incandescent. The reason is that no substance I know of has the same expansion point as carbon, and until a substance is found that will expand under heat in the exact same ratio as carbon the experiments will not be a success."

PROGRESS IN DYNAMOS.

"What is the tendency in the matter of sources of electric light? I mean as to the multiplication of isolated plants, or the growth of large central stations?"

"Decidedly in the direction of large central stations. Economy lies in that direction, and economy ultimately governs all commercial transactions."

"What was the largest dynamo used in electric lighting at the time you invented the Edison lamp?"

"Twenty-five horse-power for continuous current dynamos. It was always my idea that progress lay in the direction of larger and larger plants. In 1881 I constructed a 175 horse-power dynamo at Menlo Park, and, if you remember, sent it to England, where it attracted great attention, but, strange to say, the example was not largely followed. Whether from timidity in the management of them, the unreadiness of capital to go into the business on a large scale, or to the fact that its use lay largely in the hands of rich individuals who wanted to use the light for their own purposes, a reaction set in which lasted for several years, and the larger dynamos were not constructed."

"How is it now?"

"For the last three or four years things have tended toward my own ideas. They are going back to the original plan of large dynamos for economy."

HUGE STATIONS.

"Then you think that progress lies in the direction of great central forces?"

"I do. In the cities private plants will be less and less used. Large stations will be constructed capable of running 300,000 lights, and covering an area of ten or twelve square miles. Three plants are already in process of construction, each capable of burning 300,000 lights, or of supplying power up to thirty or forty thousand horse-power. These are for Chicago."

"What is the biggest type of dynamo now made?"

"The biggest at present is 750 horse-power. For the Chicago stations engines of 3,000 horse-power each will be used, capable of running up to 5,000 each. To each of these will be supplied two dynamos, each dynamo of 1,500 horse-power."

"How many lights are kept burning by the Fulton street station in New York, which I believe was the first central station established?"

"Twenty thousand lights and a great deal of power supplied besides. In the

the shaft. Now I'll tell what we can do and have done. We can lay down 500 horse-power at any part of the works, use it for any purpose we please, and take it away again, if necessary, in two hours."

"What was the first business building run entirely by electricity at a distance from the central power?"

"The beginning was a modest one. It was my first lamp factory at Menlo Park, a quarter of a mile away from the laboratory engine. I supplied it over a single wire with fifteen horse-power, which sufficed for the small output of lamps then necessary—and I was very proud of it, too."

"Can you name any large application of electric power in factories where you think great saving could be made by it?"

"Well, take the Fall River cotton factories, for instance. What a splendid thing it would be for them to have their power supplied from a central station. They would get it at uniform speed without any trouble to themselves at very low cost if they all combined for the purpose, and could supply it to their factories in any quantity or at any speed they choose for themselves, absolute mastery on this point being an important recommendation of electric power."

ALADDIN'S LAMP.

"Your reference to the little lamp factory at Menlo Park tempts me to ask you something about the lamp manufacture. What was the cost of the first lamp you made for commercial use?"

"I need not tell you that the experimental lamps were very costly. The first lamps manufactured for sale cost, however, $1.25 apiece. This has since been reduced to the neighborhood of 40 or 42 cents. Of course you know I was an enthusiast about the lamps. I, therefore, undertook their manufacture at the beginning, contracting with the Electric company at 40 cents apiece. I felt I would be able to do it, but meanwhile I had to go on manufacturing the lamps as they were demanded, and they were costing me a dollar a lamp to make—not a very profitable business, you can see. On that basis I turned out 40,000 lamps in 1881, which was the first year of steady manufacture. For the first 60,000 lamps the same relative basis stood good, and, in fact, I was out $170,000 before I reached the turning point."

"How was this done?"

"It would take me from this to-morrow night talking steadily all the time to tell you how it was done. Every cent of the reduction had to be fought over

Edison's Residence in Llewellyn Park, N. J.

like a battle in a great campaign. Early in the struggle we were enabled to reduce the quantity of platinum used, which constituted the greatest cost of the lamp. The first great step was the abolition of the platinum clamp for holding the carbon. For that we substituted an electro-plate welding, depositing copper on the joint. Then a great struggle followed as to the material to be used for the carbons. I had been searching the four ends of the world for material. China, Japan, Central and South America, and all parts of our own country were carefully gone over, and material, promising and unpromising, was sent to me from every part of the world. With every one of these specimens I experimented, finally reaching certain members of the grass

kle of his eye, "it is a much better paste."

THE FIRST LAMP.

"Wont you tell me about the first carbon lamp you ever made?"

"Ah, that is a story. The carbon of the first lamp was made of a spool of Clark's thread. All night Batchellor, my assistant—the greatest and best of my assistants, the man of infinite patience and indefatigable persistence—worked beside me. The next day we worked all day and then all night again, and at the end of that time we had produced one carbon out of a spool of Clark's thread.

"Having made it, it was necessary to take it to the glass-blower's house. With the utmost precaution Batchellor took up the precious carbon, and I marched after him, as if guarding a mighty treasure, to the glassblower's cubby-hole. To our consternation, just as we reached the glassblower's bench the wretched carbon broke.

"Batchellor turned around and looked at me and said, 'Edison, we wont sleep till we get one.'"

At the recollection Edison lay back in his chair and laughed heartily. When he had recovered from the fit he said:

"That was one of Batchellor's perpetual phrases which he had said to me a hundred times before, and which I had said to him. We turned back to the main laboratory and set to work again.

"It was late in the afternoon before we had produced another perfect carbon. The same procession as in the morning passed to the glassblower's den. It was safely deposited on the bench, where Batchellor laid it down, when a jeweller's screwdriver—a very little utensil, as you know—rolled down and broke the carbon again.

"Batchellor looked at the broken carbon with staring, wide-open eyes, and I did too. Fully a minute elapsed before either spoke. Batchellor turned around—he is a very mild-mannered man, but if uncle Toby could be forgiven for swearing, and the recording angel blotted out the old soldier's oath with a tear, surely he did the same for Batch.

"'Well, I am d——d,' said Batch, and then he added with a grim look on his face: 'Job got too d——d much reputation for patience on a small capital.'

"So, disappointed but not disheartened, we turned back again, and before night a carbon was completed and inserted in the lamp. The lamp was exhausted of air and sealed, the current turned on, and the light that is to be the light of the world met our eyes for the first time in all its beauty."

"Can you tell me how many children of that first lamp there are in the world to-day?"

"I cannot," he answered.

"Do you know, Tate?" he said, turning around to the secretary. The secretary shook his head.

"I suppose it is past finding out," continued Edison, "but the output of the United States is fifty thousand a day. Of these the Edison Company manufactures one-half—say, twenty-five thousand a day.

"And," he added, with a certain grimness, "will manufacture the entire fifty thousand or as many more as the country needs. The output of lamps for the whole world is eighty thousand a day, or twenty-four millions a year. This gives you an idea of the growth and spread of the electric light. Twice as many lamps are made in a day as sufficed for a whole year ten years ago. If you calculate the lamps at 40 cents each you will see that the world is paying little short of $10,000,000 a year for the children of the lamp that made Batchellor consider Job something of an impostor."

"A question of very great interest to the public is whether the falling into your hands, under the decision, of the monopoly of manufacture of the light will raise the cost of the lamps to the public?"

"It will do nothing of the kind. The increase of output will work a reduction in the cost of manufacture, so that there will be no necessity to charge the public an additional rate for the lamp, enough additional profit going with the reduction on the larger output."

"I suppose your energies are altogether centred now on perfecting the machinery of these magnetic ore separating works which we see before us?"

ORE AND ORE.

"That is so. I have spent a good deal of time here of late and shall be here some weeks yet. I have constantly

DO WE NEED TO SLEEP?

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SUNDAY, JULY 2[illegible], 1891.

A DAY WITH EDISON.

in the World.

'THE LARGE END OF THINGS.'

Some of the Secrets of His Great Success in Life.

DO WE NEED TO SLEEP?

The Future of Electric Lighting and Electric Motors.

A BLACK FRIDAY MEMORY.

The First Electric Lamp and Job's Over-Estimated Patience.

PLANS, PROJECTS, RESOLVES

How He Heard the News of His Ten-Million Victory.

A 5,000-Ton Salute to the Journal from His Mountain-Crunching Ordnance.

EDISON AT WORK AND PLAY.

"I like to begin at the large end of things: life is too short to begin at the small end."

The speaker was Thomas Alva Edison, the most interesting man in the world, the most daring and many-sided investigator in the wide domain of physics that time has seen: the most prolific inventor of an inventive age: the man who, making the mighty force we call electricity his special field, has turned his inquiring glance hither and thither and conquered domain after domain of science, ever evolving something of practical, every-day use and benefit out of materials and processes that have been merely the dreaming-ground of students and philosophers.

To the thoughtful mind he could not have been seen to better advantage than he was at the moment he uttered the words at the head of the article. It was Edison seen in one of the intervals [illegible] painted, two-story cottage at Ogden, in the shaggy, rocky and hilly northern end of New Jersey, where he sleeps and eats when he is overlooking his great magnetic rock crushing enterprise there. He had risen and made a sweeping gesture, showing the breadth of his chest as he did so, and the masterful light in his face as he uttered the words, "the large end of things," was worth a journey to see.

What did the words mean? They meant that in taking up a subject for investigation he preferred to view it in its widest limits of application to human life and action.

"The larger includes the smaller," he went on," the details grow out of the principle. The small and petty are at the hands of every man to do. We are apt to be impressed by the bowlder before us and not reason with the mountain above us that the bowlder rolled down from."

THE MOUNTAIN-EATER.

Hills were around us covered with green. A sharp slope covered with a poor grass ran down before the cottage. There was a narrow footpath, foot-worn through the herbage. Rocks protruded here and there through the thin soil. A few maples and plane trees, with a rank underbrush about them from which cowbells tinkled, were on the hillside at the right. But the glance passing these grateful green spots by rested on a long line of high frame buildings, oblong and ugly, that stretched out along the opposite side of the valley. Behind the line of "mills" one first noticed a great conical cream-colored heap, say fifty feet high, which spread out a couple of hundred feet at its base, and beyond that again a hillside literally torn open and broken down in front, its rocks split and fended in every direction—a small mountain in process of obliteration. The mountain was going piecemeal into the mill, and, crushed in steel jaws, powdered between steel rollers, carried in dust on broad belts, was on its way to the great ten-ton magnet, which, by its natural magic, would divide it into creamy rock dust to add to the giant cone outside, and into coal-black magnetic oxide to be taken off by train to the Bessemer steel mills in the Lehigh Valley.

The tall chimney above the "works" begins pouring forth a plume of black smoke, showing that the dinner hour is over. The whistle is blown. A crowd of swart Italians are seen going with lumbering gait to the "benches," as the places of quarrying are called. With a rumble and roar the novel machinery of the stone mill is put in motion, and a volume of dust comes up that drapes the ugly buildings in a creamy cloud.

The men who have been eating their dinner are tending the big steel teeth and the magnetic maw that are chewing up and digesting the mountain.

It is a live instance right before us of what Edison means by beginning "at the large end of things."

LARGE IDEALS.

"Did you ever read Edgar Allen Poe's 'Domain of Arnheim?'" said Edison, turning around.

"Yes; the hero, Ellison, was immensely rich and he found true poetry in landscape gardening."

Edison laughed. "Well, that way of putting it rather takes the poetry out of it: but he loved the beautiful, and he sought to realize it on a grand scale. He did not aim at the small. He pursued his object unweariedly. He went through all the drudgery necessary to reach his ideal. He sought to do rather than to be known as achieving, and Poe says of him that in a contempt of ambition he found the principle of earthly happiness. That is my idea—to work on at what best pleases me, to let the object be great enough, and when that is done with to begin with something else.

"Work that interests me is delight. If it does not call too much on the physical powers it is not exhausting, no matter how prolonged."

HOW HE WORKS.

"You don't prescribe eight hours a day for yourself."

Edison smiled and looked sidewise at his blond young secretary, Mr. A. O. Tate, who was twirling his mustache in an easy chair hard by.

"Eh, Tate!" he said, and then he laughed aloud.

He sat down again and said: "What is sleep?"

Then answering his own question, he went on: "Sleep is only relaxation of the muscles and the nerves. Do you know I have a curious thought that man wants to sleep simply because the world goes round in twenty-four hours? In the old times before man had any artificial light he had perforce to go to sleep when the sun went down. I am morally certain that if we had artificial light in sufficiency for, say a million of years, man would never sleep at all."

"Then you still keep up your nocturnal habits and defy the power of sleep?"

"I am serious about what I say," he answered. "Now see here. I came to this place to get rest. When I got here I found a number of things that were necessary to be done. I could not rest until I did them. During the first week I was here I had in all fourteen hours' sleep. During the second week I had twenty-two hours. What was the result? I gained six pounds."

"What did you attribute that to? Did you eat in proportion as you lost sleep?"

"Why," he said, laughing, "a man only requires one pound of solid food a day. That and a little water will see any man through."

By such expressions we may gauge something of the enormous vitality and energy of the man.

"Want of sleep," he continued, "is like the want of morphine. If a man once takes morphine he must have more of it, and it is so with sleep. Now, there is Freddy Ott. I call him my mascot, because when we work together I always hit what I want to. The reason is that Freddy never gets sleepy before I do. The other night I had a gang of men working with Freddy and myself. We stuck at it all day and all night, until 4 o'clock in the morning and, as the other fellows were looking sleepy, I thought I would knock off and tell them to take a good rest and be back at 7 o'clock. Well, they all came back, but Freddy was as fresh as a rose and all the others looked as if they had been on a spree for a week; dull and heavy-eyed, half drunk with sleep."

PATENTS AND PIRATES.

"I suppose you have received a great many congratulations on the decision of Judge Wallace in your suit?"

"Yes," said Edison; "they have been coming from all parts of the world. It is a great thing to have a layman, as we might call Judge Wallace, see so clearly into the heart of the contention. My great fear in the matter was that the arguments might have so befogged the central issue that any one might have been pardoned for confusing it with the smaller ones."

"What effect will it have upon you?"

"I cannot imagine how much this is worth to me in money. The amount is so vast that I cannot tell. But what I value more than money in that decision is that it recognizes whatever small skill I may have."

"Did not the long litigation dishearten you somewhat?"

"The patent laws," Edison answered, "are made for the protection of the inventor, but they operate to his disadvantage if any one has capital enough to steal his inventions. In my case, with a rich company at my back with plenty of means, it resulted as you know, but picture a poor inventor with his inventions in the clutch of pirates like those whom the decision of Judge Wallace so denounced."

"Did this knowledge of the patent law have any effect in directing your energies away from electricity?"

"It would take wild horses to take me away from electricity, but I did feel for a long time that my energies could be most profitably directed to the study of what may be called trade secrets rather than seeking discoveries whose protection involved patent rights."

"Then this decision really cheers you as an inventor as well as a property-owner?"

"As I said before, it makes me feel that I am not working to be robbed by others. By the way, I would like to correct an idea that seems to be pretty generally held that I make my money out of patents. That is not a fact. I make my money out of manufactures, not out of patents, although the pro- [illegible] thousand a second light might be produced without heat."

"Yes, it has long been a problem in the electric world, but it is surrounded by difficulties. Tesla worked for me in New York.

"He was brought over from Paris by Batchellor, my assistant. He has made no new discovery, but has shown considerable ingenuity in increasing vibrations. He gets his results from the inductive coil and the Geissler tube. One

"There was Jim Fisk with a dainty flower in his buttonhole."

great trouble is in the quality of the light if it is produced by that means. It is of a ghastly color. You cannot get a pleasant, mellow, yellow light without using low temperature waves as well as high.

"It is, however, fundamentaly difficult," he continued, "to make the principle valuable commercially because of the loss of power in transmission. If you tried to send with our present means such a current half a mile you would have no results whatever at the other end, because at such high pressure the force would scatter in every direction. With the high waves wood is just as good a conductor as copper. It is the same principle as I employ in my telegraphy by induction, where I have taken messages with the line at 150 feet distance. Light without heat may be obtained some day, but I do not care to prophesy that it will be a pleasant light. It will be more like the light of lightning bugs than anything else."

"From what direction do you think it will be arrived at?"

"Well, I am working at it myself, but I do not care to say in what direction."

THE RIGHT ROAD.

"Let me ask, Mr. Edison, on the general topic of invention, what determines the precise bent of the inventor in working?"

"Ah! there is the great trouble. From the moment you start out you find choice of objects before you. Lured by an apparently smooth road you are led into pitfall after pitfall. The majority of men, in seeking to solve difficult problems, work on a wrong principle for years. Success most frequently lies in the direction of the most difficult and unpromising path. In other words the searcher generally rejects the right principle. You may set it down that electric light without heat will be got somehow."

LONG-LIVED LAMPS.

"I suppose electric light without heat belongs to what we call the great future. What will be the light in the immediate future?"

"I should say it is an improvement in the development of the incandescent light. Experiments will proceed in the direction, for instance of larger lamps, of smaller lamps and of lamps with longer life. Probably what might be called the type lamp has definitely been decided on, as that of sixteen candle-power which you now see everywhere. [illegible] has already been extraordinary. At the beginning, when I first invented the lamp, the utmost we could get per horse-power was six lamps, sixteen candle-power. After a while we raised it to eight, a little later to ten, then to twelve and finally, by degrees, to fifteen. Every step in increasing the number of lamps per horse-power is attended with greater and greater difficulty, but I have no doubt that ultimately the product per horse-power

"The others looked like a row of corpses stacked around on chairs."

will reach as high as thirty sixteen-candle lights.

"Now, with the use of the triple expansion engine we are almost able to get one-horse power for one hour with one pound of coal. At any rate, that plenty of results will soon be reached. You can see from this how gradually cheaper and cheaper it will be, and therefore how much more certainly its use will spread, for where it comes into competition with gas, other things being equal, it always wins."

"How will that work out with regard to the lighting of houses?"

"The average number of burners in a house is ten. They are lighted on an average of three hours and a half each. Conceding that the limit of production both as to horse-power from coal and candle-power from horse-power, is reached you can see that three houses can be lighted for an hour with one pound of coal. Now the cost of coal is, say, one-eighth of a cent per pound, or eight pounds for a cent, so that for a half a cent three houses could be lighted during the evening. In other words, an ordinary house could be lighted at 60 cents per year—as far as coal is concerned. Of course, the great item of cost in incandescent lighting comes from the costly nature of the plant. Therefore, you may set it down that any electric system of lighting which will beat the incandescent light must do away with the great investment necessary at present."

UNIQUE CARBON.

"On the point of the length of the life of a lamp, I have been told that experiments have been made of applying certain salts to the carbon, the crystals of these salts acting as a sort of sheath to the carbon, and so tending to prevent its destruction."

"Yes, many such experiments have been made, and I have made a great many myself, but the trouble is that everything I have applied to the carbon externally flies off when the carbon becomes incandescent. The reason is that no substance I know of has the same expansion point as carbon, and until a substance is found that will expand under heat in the exact same ratio as carbon the experiments will not be a success."

PROGRESS IN DYNAMOS.

"What is the tendency in the matter of sources of electric light? I mean as to the multiplication of isolated plants, or the growth of large central stations?"

"Decidedly in the direction of large [illegible] Three plants are already in course of construction, each capable of burning 300,000 lights, or of supplying power up to thirty or forty thousand horse-power. These are for Chicago."

"What is the biggest type of dynamo now made?"

"The biggest at present is 750 horse-power. For the Chicago stations engines of 3,000 horse-power each will be used, capable of running up to 5,000 each. To each of these will be supplied two dynamos, each dynamo of 1,500 horse-power."

"How many lights are kept burning by the Fulton street station in New York, which I believe was the first central station established?"

"Twenty thousand lights and a great deal of power supplied besides. In the station near the Tombs there is a capacity of 120,000 lights."

"Has the cost of the stations decreased comparatively?"

"Yes, indeed. The Fulton street station cost $800,000; a year later I was in the position to duplicate it for $250,000. Now it could be duplicated for $120,000."

"On the question of power for factories and buildings, running elevators, and so on, do you think that the electric power will be readily taken?"

"Well, it is this way. Is it not much better in the cities where space is so valuable to save the room taken up by engines and boilers where power, say up to 100 horse-power, can be had which merely requires the small space necessary for a motor?"

"What regulates the cost of electric lighting for consumers?"

"Mainly the price of the coal. Rent and cost of labor vary also. Thus, in Philadelphia, where coal is cheaper, the light is supplied at $1.50 for a light equal to 1,000 feet of gas. In New York the same costs $2."

"Is there economy in the use of electric power on a large scale?"

"That is a question which must be answered differently in individual cases. If you take the case of a large cotton mill, where, as the business grows, mill after mill is added to the original building, the custom is to erect new engines and [illegible] for each mill. By the use of electric power the entire motive force of the establishment can be centralized with what might be called a mobile capacity that cannot be enjoyed at present."

ALL ELECTRIC POWER.

"Are any of the large mills of the country run entirely by electric power?"

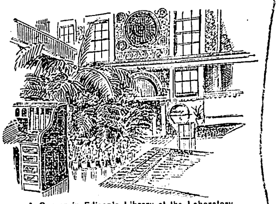
"The only establishment, on a large scale run entirely by electric power is our own works at Schenectady. The works cover an enormous space and include forty-two shops, employing 3,000 men. We had gone on adding engines and boilers as others had done in other branches of business before us, but latterly we have erected a central power house separate from all the other buildings. From that building, which is run by an 800 horse-power engine, the power is supplied to the shops. In this way we abolished no less than seven engines. A great advantage [illegible] the saving of heat to the workers. [illegible] there is also immense economy of po[illegible] because it is now supplied from th[illegible] [illegible] or direct to the shaft. Now I'll tell what we can do and have done. We can lay down 500 horse-power at any part of the works, use it for any purpose we please, and take it away again, if necessary, in two hours."

"What was the first business building run entirely by electricity at a distance from the central power?"

"The beginning was a modest one. It was my first lamp factory at Menlo Park, a quarter of a mile away from the laboratory engine. I supplied it over a single wire with fifteen horse-power, which sufficed for the small output of lamps then necessary—and I was very proud of it, too."

"Can you name any large application of electric power in factories where you think great saving could be made by it?"

"Well, take the Fall River cotton factories, for instance. What a splendid thing it would be for them to have their power supplied from a central station. They would get it at uniform speed without any trouble to themselves at very low cost if they all combined for the purpose, and could supply it to their factories in any quantity or at any speed they choose for themselves, absolute mastery on this point being an important recommendation of elec- [illegible] cost of the lamp. The first great step was the abolition of the platinum clamp for holding the carbon. For that we substituted an electro-plate welding, depositing copper on the joint. Then a great struggle followed as to the material to be used for the carbons. I had men searching the four ends of the world for material. China, Japan, Central and South America, and all parts of our own country were carefully gone over, and material, promising and unpromising, was sent to me from every part of the world. With every one of these specimens I experimented, finally reaching certain members of the grass



A Corner in Edison's Library at the Laboratory.

family which we know as cane or bamboo.

THE PIRATES AGAIN.

"By the way," said the inventor, with some show of anger upon his broad brow, "it was one of the things which always made me hopping mad to think of the pirates in the electric business, not merely stealing the radical invention which made the lamp possible, but taking advantage gratis of the long line of thousands of experiments which I had made night and day for a couple of years. At the same time there went on experiments for cheapening the machinery to manufacture all parts of the lamp. You see we had, as we nearly always have, the necessity of inventing the very tools to use, as well as the machines of manufacture, every one of them taking time and costing money."

"I observe that you no longer use the electro-plate welding for joining the carbon to the platinum?"

"No. That is funny. We began with the very first lamp by using a simple paste. Now, after years of experimenting, we have gone back to paste.

"But," he added, with a slight twinkle of his eye, "it is a much better paste."

THE FIRST LAMP.

"Wont you tell me about the first carbon lamp you ever made?"

"Ah, that is a story. The carbon of the first lamp was made of a spool of Clark's thread. All night Batchellor, my assistant—the greatest and best of my assistants, the man of infinite patience and indefatigable persistence—worked beside me. The next day we worked all day and then all night again, and at the end of that time we had produced one carbon out of a spool of Clark's thread.

"Having made it, it was necessary to take it to the glassblower's house. With the utmost precaution Batchellor took up the precious carbon, and I marched after him, as if guarding a mighty treasure, to the glassblower's cubby-hole. To our consternation, just as we reached the glassblower's bench the wretched carbon broke.

"Batchellor turned around and looked at me and said, 'Edison, we wont sleep till we got one.'"

At the recollection Edison lay back in his chair and laughed heartily. When he had recovered from the [illegible] increase of output will work a reduction in the cost of manufacture, so that there will be no necessity to charge the public an additional rate for the lamp, enough additional profit going with the reduction on the larger output."

"I suppose your energies are altogether centred now on perfecting the machinery of these magnetic ore separating works which we see before us?"

ORE AND ORE.

"That is so. I have spent a good deal of time here of late and shall be here some weeks yet. I have constantly found things to remedy and means of improvement, and little Freddy Ott and myself have had a splendid time in setting things right. I have made one improvement within the last two weeks—regulating the automatic feed of the rollers in the mill—which will save thousands annually in repair and save the labor of twenty-five men.

"This is a great business. It illustrates what I mean by beginning at the large end of things. The main invention has been before the world for ten years. The iron and steel men who looked at it immediately pooh-poohed it. When I showed them the pure magnetic oxide in fine powder produced by my process they said it was very good ore, but it could never be worked, as it would blow out of the furnaces and produce plenty of dust, but no iron. I went through a great deal of searching and experimenting to find the proper place to begin. My attention was first drawn to large deposits of sea sand off the coast of Long Island—sand rich in magnetic iron. The specimens produced by working it were splendid. Then came the damper from the iron men. The thing lay unattended to for three or four years.

A SHIFTING EMPIRE.

"When I took the iron idea up again I sent out prospectors over the same

ground, but one and all they returned to me like the dove to the ark, without anything. They reported that the Winter before all the sand containing iron had been carried out to sea, but that the farmers and clam-diggers there had united in encouraging them with the hope that 'mebbe it would return in a year or two. It mostly did.' Their faces were as long as milestones as they told me this, but I patted them on the back and said: 'Well, your journey has not been for nothing. I do not want to be the lord of an empire of shifting sand like that.'

"I did not want to find my property on dry land to-day and in the mid-Atlantic to-morrow. It teaches me that for a continuous thing good country rock is good enough for me. And so I began my search. Up here at Ogden they had been working a vein of magnetic iron for the last fifty years. You can see the old shaft behind that clump of trees down there.

THE NEW AND THE OLD STYLE.

"They bored and bored their little hole six hundred feet down," he continued, "and up and about and under the rock following the vein, only taking it out where it was rich enough in iron to be sent directly to the furnaces. Now see the difference. Unless they got 50 per cent of iron it was no good. I am tearing down the mountain wherever there is 20 per cent of iron in the rock, and getting it all out. We own pretty nearly the entire county around here now. You can drive for six miles without going off our land, and there is enough chewing for all the machinery that can be put in to last a century or two. There is sixty millions' worth of workable rock in sight. That is the large end of things, isn't it?"

"Well, if you don't want the ocean it would seem that you want the earth."

"No; all we want is to get the iron out of a little chunk of it.

A GRINDING MONOPOLY.

"By the way," he said, "before you came up I was handed a number of clippings from different papers and I see in one or two places the opinion growing up that although Judge Wallace's decision was righteous and restored my own to me, yet really it should be 'viewed with alarm' as creating another 'vast, grinding monopoly.' That's funny, isn't it?

"Now," he said, pointing to the works below him, "that is the only 'grinding monopoly' that I am connected with. I do not care much to banter about words, for this play upon terms serves no useful purpose, and the casuists can find occasion in any phrase, as, for instance, when the old lady returned to Washington Market and said reproachfully to the man at the stand:

"'You sold me this for a Spring chicken, and I tell you it was tough.' 'Well, ma'am,' replied the dealer, 'it was a tough Spring.'"

MUSIC OF THE SPHERES.

"You, nevertheless, do not cut yourself off from other enterprises because you are so deeply interested in this?"

"Oh, not at all. Every field is part of my province. I have passed within the last two weeks from delicately considering the seventh overtone of a violin on the phonograph down to the music of crunching and grinding rock. I occupy myself, besides, in my intervals here, mentally elaborating my plans for listening in the future to music mightier than ever heard before by the ear of man. I believe that with the appliances I am constructing we shall yet listen to the sound of the roaring of the flames in the mighty furnace of the sun, ninety million miles away."

As he said this he walked to a corner of the piazza and pointed up over the hill.

"You can see," he said, "where the line of telegraph-poles runs, encircling the vast deposit of magnetic rock? I have the copper wire ready to string these poles, and the first chance I have I shall do it. Then the great experiment begins."

ELECTRIC MOTORS.

"What do you think about the future of electric motors?"

"They are bound to grow. Many improvements necessary in the manufacture and installation of the electric light switched me off from that subject at a time that I was loath to give it up, when, as you know, I had constructed a motor at Menlo Park—and you rode upon it yourself over ten years ago—which did everything that has since been done; but I am at it again."

"Do you think the 'trolley system,' as it is called, will become widely extended?"

"No doubt it will. It has great advantages in sparsely populated places, but I doubt its being permitted on a large scale in the great cities, where, if any place, it would reach its highest point of perfection."

"Might I ask what you are doing in the matter yourself?"

AN ENGINE FOR VILLARD.

"I cannot for obvious reasons, give

ingly as the needs of existence will permit.

"Solid work," he said "must be the basis of all true happiness. Men who deal solely in the work of others are liable to crosses and upsets that he who works with his hands knows nothing of. I well remember 'Black Friday.' I had charge at the time of the indicators in the Gold Room when Fisk and Gould made their celebrated "corner."

BLACK FRIDAY.

"Heavens! what a pandemonium it was, the place packed to suffocation, all the men shouting as if a hundred devils were after them and wriggling in and out through each other like a mass of eels. I climbed up to a good point of vantage to look down on them and the impression left on me was ineffaceable.

"Around in Belden's office I had a friend who had charge of the telegraph instrument and it was there that Jim Fisk had his headquarters. I went around to see him and looked into his room. There was 'the only Jim' in his velvet coat with a dainty flower in his buttonhole, champagne glasses about the place, a dozen bottles of champagne on ice and Fisk laughing and telling funny stories to those about him.

"But in the outer office what a contrast! Twelve men or so were seated there on chairs, their faces white, their hands hanging listless, and despair in every line of their expression and attitude, and they looked like a row of corpses stuck around on chairs. My God! it was horrible to look at them. That was a great lesson for me. There was not a man who worked with his hands in that horror-stricken crowd."

FOND OF NOVELS.

Asked about his recreations, Edison said that he loved to go down to the seaside and fish and read novels.

"Do you know it is an odd thing," he said, "but I like exciting novels, Indian stories, hairbreadth escapes and that sort of thing. I was very sorry when I heard that Gaboriau was dead. I suppose he has left nobody who will fill his shoes. I like Poe's tales. He had great imagination and wonderful ingenuity. I spoke to you a little while ago of his "Domain of Arnheim." I liked that."

No doubt the bent of Edison's mind, compacted itself of imagination and ingenuity, finds something kindred in detective stories, in tales of great exploits and the like rather than in the novels which are mainly analysis of character and waterings of philosophy.

SHARK AND INVENTOR.

He told a story of one of his Summer recreations when staying at Punta Rassa, in Florida. We had been talking about shark fishing, and he related how with three companions he had been sailing outside the bay in a yacht. Returning through the Boca Granda, they were seeking refuge from a rising storm in the less troubled waters of the bay, but a heavy ground swell followed them and, as the bay is shallow, one heavy wave lifted up the boat and then, as it passed on, allowed it to go down with a thump on the hard sand at the bottom. This started the timbers of the boat, which began to fill with water.

"I can swim," said Edison, "and so could two of the men with me, but the third could not. Our idea was in case she filled with water to swim to a sandbank, which rose out of the tide not very far off and we were engaged in getting ready some kind of a timber raft on which our friend who could not swim could float until rescued, when on looking over the side of the boat toward the sand-bar we could see the dorsal fins of not less than fifty sharks in sight, some of them enormous, fifteen-footers, and all man-eaters. It was a troublesome quarter of an hour, I can tell you, but fortunately we were enabled to have our signals of distress answered and to be taken ashore, or it is very certain that your humble servant would not be sitting here telling yarns about Florida sharks."

A 5,000-TON SALUTE.

Then we went down to the ore-separating works, and the great inventor took delight in showing all his improvements, his powerful engines, his giant crushers, and explaining the still bigger crushers which he will presently have constructed; and showing us the shivered rock running on the lofty skips in boats carrying three tons at a time from the benches of the mountain, where the 300 Italians were at work. A couple of hours were consumed in this way most interestingly. The sun was getting lower and the light was getting mellow until the time came for the work of the day to cease, when the day shift was quitting work.

"We do not pause here day or night," he said, and he pointed to a long row of arc lights on each side of the mountain, which would presently be lit so that the night shift could take the places of those who had toiled during the day. A long stream of men trudged heavily up the incline and then crossed the hill

der. He opened his eyes and said, lazily:

"'What is it?'

"'Got up,' said I. 'I have good news for you.'

"He sat up in the bed and smiled. 'I know,' said he, 'the screening plates have come.'

"'Better than that,' said I.

"'Then it must be the pulleys?'

"'Better than that still,' said I, for at the time I was fumbling among the papers to get the dispatch out, 'and here it is.'

"I handed him the telegram and he sat on the edge of the bed and read it through. Then he looked up at me and he said:

"'Aint it a daisy?'"

"He sat still for a few moments, got up and came down to dinner. A glass of water was all he drank. He went back to work as if nothing had happened, but I know it pleased him all the way through."

EDISON'S EARLY CAREER.

Newsboy at Twelve, "Making a Name for Himself," Editor at Thirteen, Chemist at Fourteen and Electrician at Fifteen.

Thomas Alva Edison was born on February 11, 1847, at Milan, Erie County, Ohio.

His father, Samuel Edison, was of New York descent and Dutch stock, his grandfather, the present Mr. Edison's great-grandfather, having been a banker on Manhattan Island before the Revolution. The inventor's mother was a Miss Mary Elliott, a member of the famous old Massachusetts family.

During his boyhood the building of the Lake Shore Railroad closed the Milan Canal and sealed the fate of the Wizard's native town. His family went to Port Huron, Michigan, and there his mother superintended his education, for Edison never passed two months in school in his life. He soon developed a taste for reading, and before he was twelve years old he had devoured Gibbons's "Rome," Motley's "Rise and Fall of the Dutch Republic," Hume's "England" and "History of the Reformation."

His Change of Name.

It was at this time that he changed his name to Thomas Alva, for he was christened "William." The "Thomas" was taken out of respect to an uncle whom he deeply revered, and the sound of "Alva" attracted him to the cognomen of the grim Duke, which he found in the history of the Netherlands. This was his first effort at "making a name for himself"—an omen of greater things to come.

It was while he lived in Port Huron that Edison began his career as a newsboy on the Grand Trunk Railroad. He ran from Port Huron to Detroit and back. He also ran three stores in Port Huron—a book and a vegetable store and a newsstand. All these were distinct, and he had eleven boys in his employ.

Soon he was obliged to spend most of his time in Detroit, and while there he began the task of reading all the books in the Detroit Free library.

He started at the big tomes first and went through the Encyclopedia. Burton's "Anatomy of Melancholy" followed, and Ure's "Dictionary of the Sciences" came in its turn. Newton's "Principia" was read, but not digested.

This last book gave Edison his first opinion of mathematics. He found a problem which he could not understand and asked a friend's aid. The puzzle was explained in a few simple words.

"This," says Edison, "gave me an aversion to mathematics which I have never overcome, and I think Newton could have diffused his knowledge over a much wider field if he had known less about figures."

Editor and Publisher.

Early in 1862 Edison became an editor. A freight car on his train was designed for a smoker, but it was so uncomfortable that it was never used, and this he fitted up as his printing shop. He bought some old type and electrotypes from the Detroit Free Press and then built his own press. His paper was the Grand Trunk Herald, and he was editor, reporter, typesetter, printer and devil. The sheet was devoted to local news about the employes of the road, and had over four hundred subscribers. It lived for nearly a year.

His travelling sanctum became a chemical laboratory, and many of the passengers used to watch him at work. One day he upset a bottle of phosphorous and set the car on fire. Then he was ejected.

His enterprise was unquenched, however. At every station was a blackboard which had been used to announce train time on, but which was then discarded.

He secured the services of the operator at Detroit to telegraph a bulletin of the news along the line, and had the station operators chalk it up on the blackboards. The war of the rebellion was then in progress, and rich was the harvest his bulletins brought him.

On April 5 and 6, 1862, the battle of Pittsburg Landing was fought and Edison's bulletins announced "fifty thousand

morning and he was at once made permanent operator.

Then he entered the army telegraph service at Memphis, and there it was that his repeater was invented and put into operation, and for the first time New York and New Orleans were directly connected.

After serving in various capacities and continually losing situations because he would experiment instead of work, Edison went to Boston. It was Winter, and he had on a Summer suit and a straw hat.

He caused a great deal of merriment in the operating room, but after he had set hour after hour taking "press" as fast as the swiftest operator in New York could send it, he won the respect and admiration of his associates. It was while he was in Boston that he received his first patent. It was for a note-announcer for the use of legislative bodies.

The Beginning of Success.

Mr. Edison's success dates from the time when he fixed the main transmitter in the Gold and Stock Reporter office in New York. It was during a gold fever, and the stopping of the tickers nearly caused a panic in Wall street. Edison happened to be passing Mr. Law's office and, seeing what the trouble was fixed the machine in a moment.

He was made general superintendent of the system on the spot, and from that time the history of the progress of electricity has been a history of his life.

A FAIR EXCHANGE.

He pressed a kiss upon her hand,
The maiden cried: "What bliss!
For she was fond of sugar plums,
It was a candy kiss.

When all were gone the lover cried
"My dear, this will not do;
You've taken all my kisses and
Now I'll take some from you."

JULINA.

FIRE-FIGHTERS' PALACE.

Brooklyn's New Palatial Headquarters for Its Fire Department.

The headquarters of the Brooklyn Fire Department for a great many years has been in a musty old building on Jay street, near Willoughby, where there has been scarcely elbow room,

Brooklyn's New Fire Headquarters.

and from the basement of which the odor of a stable ever greeted the nostrils.

Soon there will be a change decidedly for the better. The department is to have a new building on the old site, and the plans call for a structure which, if honestly constructed, will be both an ornament and a model of perfection.

In its exterior the new building will resemble very much the Thomas Jefferson, where the Democracy of the County assemble. The material to be used is red Lake Superior sandstone, Tiffany brick and terra cotta. The roof will be of dark-red Spanish tiles.

The building will rise to the height of 120 feet from the ground. The frontage will be 50 feet. There will be nothing tawdry about the interior.

The main entrance doors are to be of solid oak, bound with black ornamental ironwork. On the ground floor will be a wagon room, with a solid concrete floor. The halls will be tiled, as will the walls and floor of the main offices on the second and third floors.

STAR WARRIORS.

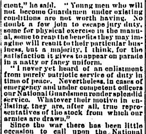
Brave Brooklyn Men in the National Guard.

Gentlemanly Soldiers Who Would Make Their Mark in Fighting for Their Country.

"Are sufficient inducements offered to young men to join the National Guard, and do most of the recruits join from a sense of duty or in pursuit of pleasure and physical benefits?"

This question was put by a JOURNAL reporter to General James Jourdan, the veteran soldier who was for a long period at the head of the National Guard in Brooklyn. There is no better authority on military matters than the old commander of the Second Division.

"I think the inducements are suffi-

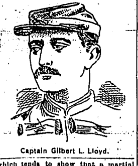


Colonel J. G. Eddy.

cient," he said. "Young men who will not become Guardsmen under existing conditions are not worth having. No doubt a few join to escape jury duty, some for physical exercise in the manual, some to reap the benefits they may imagine will result to their particular business, but a majority, I think, for the satisfaction it gives to appear on parade in a natty or fancy uniform.

"I never yet heard of an enlistment from purely patriotic service of duty in time of peace. Nevertheless, in cases of emergency and under competent officers our National Guardsmen render splendid service. Whatever their motive in enlisting, they are, after all, true representatives of the stock from which our armies are drawn."

Since the war there has been little occasion to call upon the National Guard in this State; still, they are the pride of the good citizens, and anything



Captain Gilbert L. Lloyd.

which tends to show that a martial spirit exists among the young men is comforting to those who have been themselves in the ranks and performed faithful duty.

General Jourdan does not deny that at the present time the militia regiments of Brooklyn have in them young men who care little or nothing for a showy uniform, but whose sole desire and determination is to acquire all the knowledge possible of the school of the soldier. Those young men will make their mark should their services ever be demanded in the stern realities of war.

One of Them.

In this list is Captain Charles H. Luscomb, of the Thirteenth Regiment, who finds time to do a vast amount of hard military study in spite of the fact that he has the business of a law office to look after.

Captain Luscomb is one of the most popular men in his regiment. He is well known as the commander of the Talmage Company, organized mainly from the Tabernacle flock and named in honor of its eloquent pastor. In addi-

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Colonel... He is on... to Brook... The dutie... congenial, and he studied Upton with all zeal. In less than two years after enlistment he was elected second lieutenant. A year later he was advanced one peg, and in April, 1881, he became adjutant of the command.

The Colonel comes of a military family. His great-grandfather, John Eddy, was captain of the first company of trained bands of the town of Gloucester, in the county of Providence, R. I. Governor Nicholas Cooke gave him his commission on May 6, 1776. Captain Eddy called out his company in the Fall of that year to help down the Governor's British friends.

BROOKLYN ATHLETES.

Fred Babcock will take up track athletics again and will compete in some of the Fall meetings. He will wear the colors of the Varuna Boat Club.

The Star Athletic Club is getting up a strong team of athletes to compete in the Long Island Amateur Athletic games next month. The men whom the club will depend upon are Ryan, Heaton and Boyle, in the sprints, Fitzgerald and Flanagan in the distances, and O'Grady in the weights.

W. F. Mur... of the New York Athletic Club and K... County Wheelmen, will confine his r... entirely to track events this year.

Two of the best jumpers in the Acorn Athletic Association are F. Brainard and W. Hopewell. They are now in active training for the numerous athletic games to be held this season.

Another young athlete who has developed into a good broad jumper is E. Howard, of the Acorn Athletic Association.

Bob Pritchard, the high jumper, is doing a little practice work now and may be induced to have a tug at the stick again.

The Astoria Athletic Club has started a lacrosse team, and has already collected a number of excellent players. A number of interesting matches will be held during the season.

S. G. Frooth, of the Varuna Boat Club, is in active training for the five-mile run at the Long Island amateur league games, ... and Ed Baird, of the Va-

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body crack a... look at that same Edison, ... of black, and ... cravat, you ... were not for ... you would was. ... lapping about ... uping around ... laboratory. ... ents that his ... has the same ... men acquire, between fifty ... ged merely in ... and reporting ... experiment ... Edison never ... mind, while ... nce of how far ... st results and ... what his di... m them at the ... room, as else... nt man. He ... n consists in ... have resulted ... ants in teleg... e has learned ... sticks out all ... at once quick ... vous yielding. ... n a way he is ... e fellow who ... 's success is ... fogies are re... d the hare. ... pid. ... his way of ... bother, and, ... thing. Then ... wed out of the ... shed by rest ... will set with ... g else. But ... one can tell ... e will take a ... must be done ... experimenters ... 's got to stop. ... rt early in the ... ait around all ... By the third ... cept eat lunch ... n the bit of ... ork will have ... with which ... nt him work... save in the ... newspapers. ... n experiment ... for days. He ... o allowance of ... ry man under ... ain fever. ... rought to the ... five minutes ... he foot of the ... e works. He ... ly meantime. ... doesn't care so ... re the times ... n the way of ... as spent five ... y, "debarred ... barbers and ... and snatch... s of sleep in ... laboratory he ... ntervals of his ... of lathe work ... s down and in ... ong as he can ... re unharmed. ... lf an hour at a ... d, so far as it ... favorable con... s recuperative ... in the middle ... d as rain does ... p. ... ver, when the ... t Edison goes ... up on the hill ... ps until every ... nes he is snor... even twenty... doctrine that ... in the matter

gorge themselves. There's too much eating done. Why, I never eat these heavy dinners. If I did I'd be a miserable, helpless, grouty, old dyspeptic. That's what broke me up in France. They stuffed me with big dinners and I couldn't carry 'em. At home I'm a very light eater. For breakfast I eat a couple of eggs and a little slice of ham, with two or three slices of toast and some tea or coffee; and for lunch and dinner about the same.

THE WIZARD'S SIMPLE DIET.

"Tea and coffee and water are the best drinks for me. Though I have no conscientious scruples against the use of spirituous liquors, I don't care much for them, and drink them very little. I didn't like the wine-drinking over there. They told me I must drink the wine or I'd catch the typhoid fever. Well, I drank it and it made my hands tremble so they almost made a musical note. I think that typhoid fever story is just an advertising dodge to sell the wines.

"But you ought to see the lovely beer they have in England. Its specific gravity is lead, and it goes to the bottom of your stomach like the weight on a plumb line, and there it stays. I should think they'd use that beer to ballast ships with. Only it would make the transatlantic voyage 365 days long."

Still, Edison likes a sip of champagne or a bottle of beer once in a way. He repeated with great gusto some English statistics showing that the moderate drinker outlived the teetotaler by about ten years. "Why," he went on, "you take these fellows who never drink at all and you'll see 'em with pale, sallow complexions and abnormally broad shoulders, and they invariably die of consumption."

EXPECTS TO LIVE NINETY YEARS.

"By the way, Mr. Edison, how long do you expect to live?"

"To ninety years of age," he answered on the instant. "My father is eighty-seven. He walks ten miles a day, and would be ashamed of climbing stairs one step at a time. He went to Europe at eighty-four, and when in Paris his companion, a young fellow of sixty-five, proposed going out to Versailles. The old gentleman declined to ride, and they walked out and back. My grandfather lived to one hundred and three, despite the horrible influence of tobacco, and I think my chances are good for ninety, bar accidents."

"Why do you say the horrible influence of tobacco? Don't you believe in it?"

"Well, rather. That's my little joke. I believe so thoroughly in it that I smoke from ten to twenty cigars a day."

"Strong ones?"

"Strongest I can get."

"Doesn't it hurt your nerves?"

"No, I never saw a sign of it. If I thought it hurt me I'd stop it."

"Besides your reading, Mr. Edison, what do you do for amusement?"

"Oh, nothing much. I like to laugh, and I don't care for dancing, and I don't like a crowd, especially if I can't hide myself in it. I do like a good story, and I like the theatre. I go quite often and would enjoy it immensely if I could hear what the actors say, but I can't. I'll tell you. My best hold in the theatre is the light opera. There's where I get the fun. I can go there, you see, and get down in the bald-heads' neighborhood and hear the music first rate."

"Then you are fond of music?"

"Yes, indeed."

"Do you sing?"

TELEPHONES RUINED HIS VOICE.

"Well, I used to sing, but I ruined my voice experimenting. I was trying for so many years to get an intelligible sound through my telephone. I succeeded. They tell me nobody else does. But, then, I busted my larynx in the effort," and the inventor laughed at his pleasantry. In the way of exercise Edison says he does nothing at all save now and then to walk home, which takes about five minutes. "I don't feel the lack of exercise," he said. "Why should I do bodily work when I don't need it?"

He keeps half a dozen horses, but does little or no riding for pleasure. "Are you fond of horses?" I asked him.

"No. I think they're a poor motor. They're a necessary evil. I keep 'em because I have to, and there isn't a fast one among 'em. I have come near being killed twice, and I don't consider horses safe. I like a motor with a governor on it. You listen to me. In twenty-five years from now electricity will have superseded horse power in New York in the performance of every sort of needful work. The horse will have become a luxury, a toy and a pet."

"Mr. Edison, what is your object in life?

MAJOR FRANK McLAUGHLIN.

N. Y. Tribune Aug. 1891

HE LIKES TO HANDLE RIVERS AND BOXING CONTESTS.

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The most widely known and certainly the most popular member of the famous California Athletic Club is Major Frank McLaughlin, a picture of whom appears herewith. Major McLaughlin is a millionaire who made his money in mining; not in the ordinary mining, but by one marvellous stroke. Nuggets have been found, rich mines developed, and all sorts of schemes put through for the despoliation of nature of her precious metals, but it remained for Major McLaughlin to turn a mighty river from its bed, and then deliberately help himself and the company behind him to the treasures the mountain streams had been for untold centuries washing down from the hillsides and depositing in this central basin. The genial Major turned aside from its course by means of huge dams the Feather River at Oroville, Cal. Just what

MAJOR FRANK McLAUGHLIN.

an undertaking this was no one can understand who is unacquainted with the stream, deep and swift-flowing, and the unpropitious mountainous country surrounding the basin destined to be robbed of its treasure. Not thousands but hundreds of thousands of dollars were needed for the completion of such an enterprise. Major McLaughlin's ability was fully equal to his call upon it; he went to London and raised the money in short order. The success of this attempt alone after weeks or months of effort would stamp the man who accomplished it as one of unusual enterprise, energy, tact and address. What then shall be said when it is told that within three days after the Major's arrival in England half a million sterling was pledged to his project.

Major McLaughlin, who was a New-Yorker originally, displayed athletic prowess in youth, but ambition and the cares of his immense business enterprises have long since taken him out of the ranks of active competitors. He excelled as a boxer, being at one time "Billy" Edward's "crack" pupil. Major McLaughlin is now a director of the California Athletic Club, an organization composed in the main of wealthy men, who believe in encouraging athletics by giving large purses for champion boxers to compete. It is from this California Athletic Club that the present encouragement of high-class boxing comes, all other like organizations being laid out upon its lines.

of the old settlers know her, no one can remember her husband's name, and when any one asks her name she simply replies: "Old Mary, and please, sir, I am waiting for me dear husband, who will be here on the next train," and that is every word she will utter.

The story dates back fifteen years, and shows how a woman who once loves a worthless vagabond of a man will stick to him even after he has abused her in a manner that would not be tolerated in the ranks of the lowest type of the brute creation.

Fifteen years ago old Mary and her husband owned several acres of land just south of where the old San Fernando street depot now stands. Both were hard-working, saving people, and they were getting rich fast. They had built several good houses on their land, which they rented to railroad men at good rates, and had they held their property until now they would have been wealthy, but the husband had what he considered a good offer for the property, and after several consultations with his wife they decided to sell, although Mary was bitterly opposed to such a course.

She possessed more sense than her husband, and she knew that in time they might become independent if they held to their land. However, as is always the case when it comes to an argument between husband and wife, the man got the fight and a clean deed away with the fight and a clean deed was made to all their possessions.

As the wife had earned as much as the husband she was entitled by law to one-half the money paid for their land and houses, but she had the utmost faith in her husband and allowed him to handle the money.

The husband hung around a few days after the transfer was made, when he informed his wife that he was going out of town for a few days on business. She accompanied him to the depot, and they parted in the most affectionate manner.

For some days no one suspected anything wrong, and even then their suspicions would not have been aroused had they not noticed old Mary hanging around

wistful, pleading look in his eyes, and that made it all the more exasperating.

Adrian caressed the air twice with his bat, and then dropped the ball a foot south of the foul line. He ran round to third with a great deal of toil—Adrian runs like a wagon load of barrels on a corduroy road—and reached there just as Mr. Lynch's plaintive cry of foul rang through the fog. Then he came in and took another try. The step-ladder Esper waited until Grandpa's eyes were blinking and threw a ball over the plate that burned its way through the air like a comet two hours behind the schedule.

"Three s-t-r-e-e-k-s!" cried the umpire.

Grandpa did not open his lips. He turned slowly around and gazed at Mr. Lynch in a soulful, agonizing way; a great tear stole down his tobacco cheek, and he gulped down a sob. Then he strode sadly away to the bench with a look in his blue Saxon eyes that left a shiver in the blood.

Gold Cures the Taste for Liquor.

A new treatment of inebriety consists in the administration of bi-chloride of gold in solution hypodermically and through the stomach for a period of about three weeks. Its effect for destroying the appetite for narcotics is said to be immediate. In fact, it is the practice of the physician to allow the patients to drink all the pure whiskey they want while under treatment. But none of them call for the liquor after the third or fourth day. It is voluntarily discarded and the appetite, it is said, never returns. The reports submitted show only 5 per cent of failures or relapses in 5,000 cases treated during ten years.

A Pokerish Situation.

Jack Potter—I never wished I was blind but once.

Bob Taylor—When was that?

Jack Potter—The last time I played poker. I saw a man who held four aces. Puck.

Not Stated by the Census.

Hardy—Did you know that the population of this country is declining?

Brown—Nonsense, it can't be so.

Hardy—True, though; they are declining to live anywhere else. Lowell Citizen.

Forethought.

"Our names are written in pencil in this marriage certificate," said Waldo Higgins,

"... from that subject ... that I was loath to give it up, when, as you know, I had constructed a motor at Menlo Park—and you rode upon it yourself over ten years ago—which did everything that has since been done; but I am at it again."

"Do you think the 'trolley system,' as it is called, will become widely extended?"

"No doubt it will. It has great advantages in sparsely populated places, but I doubt its being permitted on a large scale in the great cities, where, if any place, it would reach its highest point of perfection."

"Might I ask what you are doing in the matter yourself?"

AN ENGINE FOR VILLARD.

"I cannot, for obvious reasons, give you the details, but I have a better motor than ever before used, and will shortly have a better still. I am at present making a motor for Henry Villard for service on a regular railroad, which will be as powerful as any locomotive at present in use. That is to say, developing at least one thousand horse-power."

"Will it take its power from a trolley wire?"

"No; that would not answer for an engine of the speed it will attain. It will take up the electricity from the central rail."

"What is the economy in electric motors for railroads?"

"The ordinary locomotive consumes six or seven pounds of coal of a high grade per horse-power. The electric motor can be run at one-sixth of the cost for coal, for while there is a slight loss of power in transmission, the greater cheapness of the kind of coal used fully covers that. The perfect control of the motor, the absence of sparks and smoke, are surely additional advantages to recommend this to the railroad traveller and railroad manager."

"What else are you working on?"

"Well, I have a dozen irons in the fire, but, as Private Mulvaney remarks, 'That is another story.'"

EDISON'S ARMY.

"Mr. Edison, how many men and women do you calculate are working upon or getting their daily bread from your inventions?"

Edison leaned over in his chair, put his hand to his head and calculated silently for two or three minutes and then said:

"The inside calculation is 60,000 men and women."

And Thomas Alva Edison was born on the 11th of February, 1847, so that he is now in his forty-fifth year, at the maximum of his forces, and to judge by his physique and his mental acumen, destined to a long life of activity and discovery and the setting to work of other brigades, divisions and army corps of mechanics until the 60,000 perhaps becomes 600,000!

WORK AND CONTENT.

Conversation once more drifted into general channels. Contentment and happiness in life came under discussion. Edison thinks that a man should be happy who can labor. As he never spared himself he seems scarcely to comprehend the philosophy of those who peddle out their efforts as gruda-

... crushers which he will presently have constructed; and showing us the shivered rock running on the lofty skips in boats carrying three tons at a time from the benches of the mountain, where the 300 Italians were at work. A couple of hours were consumed in this way most interestingly. The sun was getting lower and the light was getting mellow until the time came for the work of the day to cease, when the day shift was quitting work.

"We do not pause here day or night," he said, and he pointed to a long row of arc lights on each side of the mountain, which would presently be lit so that the night shift could take the places of those who had toiled during the day. A long stream of men trudged heavily up the incline and then crossed the hill to where their quarters are.

"We must go further away," said Edison, leading me back toward the central works until we reached a point near the engine house, where the 400 horse-power, triple-expansion engine had ceased its throbbing.

"We will wait here."

"What for?" said I.

Edison did not answer, but pointed toward the mountain. As he did so the hills around seemed suddenly shaken as if by a blast of thunder, a mass of rock flew skyward, a cloud of dust followed it. The sounds rolled in echoing thunder around the neighboring hills. The silence which came after was broken by Edison saying:

"Well, there go 5,000 tons more."

"Take it as a salute to the MORNING JOURNAL," he added, smiling.

It was an impressive ending to our interview, and I shook the great inventor's hand and left him standing there, with the smile on his face as Freddy Ott, his mascot, all grimy with machine oil and iron dust, shouted to him from the door of one of the workshops.

HOW HE HEARD THE NEWS.

I had come up to Ogdensburg by the tiresome route of the Susquehanna Road and was returning by the Delaware & Lackawanna, whose track runs into the Edison works, and found myself there with Henry Hart, the superintendent of the establishment.

"I never thought," said I to him, "of asking Edison how he got the news of the great decision."

"Well," said Hart, "you know his way—he would hardly have told you more than a word or two, but here is the story.

"Edison had been up all night at work when I returned to the works. I sleep over at Kenvil, some seventeen miles away, and when I reached Ogden I found Edison still about. He left the office at 10 o'clock in the morning, giving orders to be called at 1. About noon I received a telegram from Mr. Insull giving the decision in substance. I at once saw its tremendous importance to Edison, yet I said to myself: 'Why should I rob the man of an hour of sleep even to give him this?'

"I went up to the house, where the boys were assembling for dinner, and the dispatch seemed to burn in my pocket, yet I did not like to wake him. I ate my dinner and it was then 12:45, and I did not think I could hold out any longer, so I went up to Edison's room and there he lay as dead asleep as any man you ever saw.

"I had placed the telegram in an envelope with some other papers. I held this in my hand and went up to the bed and touched him lightly on the shoul-

... news about the employes of the road, and had over four hundred subscribers. It lived for nearly a year.

His travelling sanctum became a chemical laboratory, and many of the passengers used to watch him at work. One day he upset a bottle of phosphorous and set the car on fire. Then he was ejected.

His enterprise was unquenched, however. At every station was a blackboard which had been used to announce train time on, but which was then discarded.

He secured the services of the operator at Detroit to telegraph a bulletin of the news along the line, and had the station operators chalk it up on the blackboards. The war of the rebellion was then in progress, and rich was the harvest his bulletins brought him.

On April 5 and 6, 1862, the battle of Pittsburg Landing was fought and Edison's bulletins announced "fifty thousand men killed and wounded."

A War Harvest.

He arranged with the engineer of his train to have his engine break down so as to hold the train for ten minutes at Detroit and then secured 1,000 extra papers on credit. These he sold along the line for from 10 to 25 cents apiece. At Port Huron he was met by a crowd which ran down to the station to secure papers. They came together in front of a church where a prayer meeting was in progress, and Mr. Edison says it was cleaned out in three minutes, and from the way the quarters dropped into his hand it was evident that the deacon had not passed the plate.

One day he saved the life of the little son of a station agent, and the father in gratitude taught the newsboy telegraphing. This was his first introduction to electricity, the power which has made his name a household word all over the world.

The telegraph office where he studied was some distance from the town, and the young man was soon so proficient that he ran a wire from the depot to the jewelry store in town and sent messages for transmittal to his friend, the regular operator, for 10 cents each. The Western Union Company soon found out that he was making money and ran a wire of its own to the town and then he was crushed by monopoly.

In His Native Town.

He obtained a position as operator at Port Huron, and while there took an entire President's message for the benefit of his fellow-townsmen. His next engagement was at Stratford, Canada, as night operator in a railway office. He let a train he was ordered to stop go past him, causing a wreck, and after an interview with the manager came back to the States.

From telegraph office to telegraph office he drifted, and at Indianapolis he made his first electrical invention. It was an arrangement to record the dots and dashes on the obsolete tape recorder much slower than they were received. The management soon found out that Edison was making experiments while his machine ran itself, and there was a vacancy in the office.

Edison then went to Cincinnati. There was a general and jovial meeting of telegraphers the night he arrived there, and when the press report began to come through there was no one to receive it. Edison let Cleve... and call for nearly an hour, and then ... walked into the office and took the report ...

The manager ... and him there the next

... there will be a change decidedly for the better. The department is to have a new building on the old site, and the plans call for a structure which, if honestly constructed, will be both an ornament and a model of perfection.

In its exterior the new building will resemble very much the Thomas Jefferson, where the Democracy of the County assemble. The material to be used is red Lake Superior sandstone, Tiffany brick and terra cotta. The roof will be of dark-red Spanish tiles.

The building will rise to the height of 120 feet from the ground. The frontage will be 50 feet. There will be nothing tawdry about the interior.

The main entrance doors are to be of solid oak, bound with black ornamental ironwork. On the ground floor will be a wagon room, with a solid concrete floor. The halls will be tiled, as will the walls and floor of the main offices on the second and third floors.

On the fourth floor it is intended to have a training school, the most complete of its kind. There is to be fine quarters for the telegraph department on the fifth floor.

Of course the new building will be as near fireproof as it is possible to make one. It will involve an outlay of nearly $150,000. Just such a structure is contemplated as the city should speedily erect for the Police Department. The Headquarters of the latter are a disgrace to the municipality.

CUPID'S CONQUESTS.

A fashionable engagement which has been announced in the Heights circles is that of Miss Esther H. Leonard, daughter of Mr. and Mrs. Lewis H. Leonard, to Mr. Underhill, of Montclair, N. J. The wedding will be observed in the early Autumn.

Among the other engagements announced in the Hill and Heights circles are that of Miss Belle Williams to Mr. Charles Edward Cole, Miss Adelaide Thurston to Mr. Frederick Worth and Miss Blanche Havemyer, of Islip, L. I., to Mr. W. Butler Duncan, Jr.

An important social announcement is that of the engagement of Miss Martha Houghtaling and Mr. F. Abbott Ingalls. Miss Houghtaling is the charming daughter of Mr. and Mrs. David Houghtaling, of Clinton avenue, and is very wealthy. She is highly accomplished and is a great favorite in social circles. The marriage it is stated will take place in the Fall.

The engagement is announced of Miss Josephine Leonard, daughter of Mr. and Mrs. Leonard, of Columbia Heights, and Mr. Charles Towel, of Rye, N. Y. The prospective bride is a very charming girl and has for the past season or two been one of the leading society belles in the Heights circles. Mr. Towel is a Yale College student and a very bright young man.

The engagement of Miss Laura B. Thorn, of Brooklyn, to Wilson H. D. Olcott, of Beacon street, Boston, which was announced last week, has caused great surprise in social circles in Brooklyn. The coming bride is the daughter of Captain and Mrs. Walter Thorn, who own a handsome residence in Fifty-sixth street, near Bay Ridge, and a country seat at Meriden, Conn. Miss Thorn is one of the belles in social circles in Brooklyn. Mr. Olcott is a son of Mr. Sidney Olcott, who with his family is travelling in Europe.

An Off Week in Journalism.

Newspaper Proprietor—What in the world has made our circulation drop off so this week?

Editor—There's been no important news, sir.

Proprietor—No important news, eh? How about that terrible railroad accident, and the big bank defalcation, and the war scare in Europe, and——

Editor—Oh, yes, there were a few little things like that, but you see it rained all week and there were no baseball games. Munsey's Weekly.

... men who care little or nothing for a showy uniform, but whose sole desire and determination is to acquire all the knowledge possible of the school of the soldier. These young men will make their mark should their services ever be demanded in the stern realities of war.

One of Them.

In this list is Captain Charles H. Luscomb, of the Thirteenth Regiment, who finds time to do a vast amount of hard military study in spite of the fact that he has the business of a law office to look after.

Captain Luscomb is one of the most popular men in his regiment. He is well known as the commander of the Talmage Company, organized mainly from the Tabernacle flock and named in honor of its eloquent pastor. In addi-

Captain C. H. Luscomb.

tion the Captain is conspicuous as a member of the Park Commission.

All through his career as a National Guardsman Captain Luscomb has shown that he does not regard the wearing of a uniform as the height of ambition. Colonel Austen will tell you that he is one of the best-disciplined men in his command. If he is ever absent from the armory it is when there is no duty to be performed there.

The Captain began his military career in May, 1877, when he enlisted as a private in Company D, Twenty-second Regiment. By 1880 he had passed through the grades of corporal and sergeant to the first lieutenancy. He was commissioned as captain of the Talmage Company in 1888. He was also captain of the regimental rifle team in 1880 and 1890.

A Hard Worker.

Some very good soldiers have been nursed and brought up by the Fourteenth Regiment. There is no organization in the National Guard which has seen so much of the smoke of battle as Brooklyn's "Red-Legged Devils." The young men in the command have every incentive to emulate the brave deeds of their comrades, who have been where the bullets were thickest.

Captain Gilbert L. Lloyd is a good militiaman. He belongs to the Fourteenth. He is the junior captain in the command, and one of the hardest working officers as well.

His military career began in July, 1876, when he joined Company B, Twenty-third Regiment. He was elected second lieutenant of Company E, Fourteenth Regiment, in February, 1884, and in June, 1880, became captain. The last position he has held since.

The Captain's associates in the com-

... mouth. The ... pend upon ... the sprints, the distance ... weights.

W. F. Mur... Club and K... continue his ... this year.

Two of the ... Athletic Asso... W. Hopewell ... training for the ... be held this ...

Another young athlete who has developed into a good broad jumper is E. Howard, of the Acorn Athletic Association.

Bob Pritchard, the high jumper, is doing a little practice work now and may be induced to have a tug at the stick again.

The Astoria Athletic Club has started a lacrosse team and has already collected a number of excellent players. A number of interesting matches will be held during the season.

S. G. Freeth, of the Varuna Boat Club, is in active training for the five-mile run at the Long Island amateur league games.

Charles Stokum and Ed Baird, of the Varuna Boat Club, will represent that organization in the high jumping contest of the Long Island League meet.

William Folker, of the Brooklyn Athletic Club, is walking in good form. He won his last mile walk in 8 minutes 3 1-4 seconds.

An athlete who is making quite a record on the cinder path is C. D. Burt, of the Polytechnic Athletic Association. His record already is a very good one, and he has won a number of prizes during the past few months.

One of the speediest riders in Brooklyn is W. H. Wells, of the Kings County Wheelmen.

Robert Ellingham, of the Montauk Wheelmen, has just returned from an 853-mile cycling trip to Niagara Falls. A large number of the members of the same club will make a tour to the Falls early in September.

Boats to the Ocean Piers.

One of the most popular excursions from New York City to the seaside is afforded by the Iron Steamboat Company, the steamers leaving West Twenty-third street, North River, and the famous pavilion pier No. 1, North River, near Battery place station of the elevated railroad. There are two excursions, in fact, one to Coney Island, the boats landing at the Iron piers, for which the excursion fare is only half a dollar.

The other trip is the five hours' sail down to Long Branch. The Iron Steamboats are the only boats running direct to Long Branch, and the rate of fare is only 75 cents for the round trip. Boats leave for both Coney Island and Long Branch from the above landings, and Long Branch travellers are landed at the Great Ocean Pier. The time-table to-day calls every boat into service, and every 45 minutes there is a boat for the Island, while the Taurus and Cepheus will both run to Long Branch.

A Clincher.

Jones was greatly annoyed by a beggar who had followed him for some distance.

"Only a nickel, sir. I haven't had a mouthful since yesterday."

"What's the use, my good fellow?" snapped out Jones, angered into speech. "You're sure to be hungry again to-morrow." Judge.

Marriage, the Reformer.

Mrs. Feathers—And you won't give me $30 for that bonnet; you, who always protested that you loved me so extravagantly.

Mr. Feathers—Well, dear, since we have been married, you know, I find it's best for both of us if I love you economically. Puck.

... body crack a ... look at that same Edison, ... of black, and ... cravat, you ... were not for ... you would ... was.

... apping about ... ping around ... t laboratory. ... ents that his ... has the same ... men acquire, ... between fifty ... ged merely in ... and reporting ... experiment ... Edison never ... mind, while ... ce of how far ... st results and ... what his di... them at the ... room, as elegant man. He ... consists in ...

... have resulted ... ants in teleg... e has learned ... sticks out all ... at once quick ... vous yielding. ... a way he is ... he follow who ... 's success is ... fogies are re... d the hare. ... pp.

... his way of ... another, and, ... king. Then ... wed out of the ... shed by rest ... t will set with ... ng else. But ... one can tell ... e will take a ... must be done ... experimenters ... 's got to stop. ... rt early in the ... sit around all ... By the third ... cept eat lunch ... n the bit of ... rk will have ... with which ... ut him work... save in the ... t newspapers. ... an experiment ... for days. He

gorge themselves. There's too much eating done. Why, I never eat these heavy dinners. If I did I'd be a miserable, helpless, gouty, old dyspeptic. That's what broke me up in France. They stuffed me with big dinners and I couldn't carry 'em. At home I'm a very light eater. For breakfast I eat a couple of eggs and a little slice of ham, with two or three slices of toast and some tea or coffee; and for lunch and dinner about the same.

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"Tea and coffee and water are the best drinks for me. Though I have no conscientious scruples against the use of spirituous liquors, I don't care much for them, and drink them very little. I didn't like the wine-drinking over there. They told me I must drink the wine or I'd catch the typhoid fever. Well, I drank it and it made my hands tremble so they almost made a musical note. I think that typhoid fever story is just an advertising dodge to sell the wines.

"But you ought to see the lovely beer they have in England. Its specific gravity is lead, and it goes to the bottom of your stomach like the weight on a plumb line, and there it stays. I should think they'd use that beer to ballast ships with. Only it would make the transatlantic voyage 365 days long."

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EXPECTS TO LIVE NINETY YEARS.

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"To ninety years of age," he answered on the instant. "My father is eighty-seven. He walks ten miles a day, and would be ashamed of climbing stairs one step at a time. He went to Europe at eighty-four, and when in Paris his companion, a young fellow of sixty-five, proposed going out to Versailles. The old gentleman declined to ride, and they walked out and back. My grandfather lived to one hundred and three, despite the horrible influence of tobacco, and I think my chances are good for ninety, bar accidents."

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"Well, rather. That's my little joke. I believe so thoroughly in it that I smoke from ten to twenty cigars a day."

"Strong ones?"

"Strongest I can get."

"Doesn't it hurt your nerves?"

"No, I never saw a sign of it. If I thought it hurt me I'd stop it."

"Besides your reading, Mr. Edison, what do you do for amusement?"

"... I like to laugh, and I ...

... the husband she was entitled by law to one-half the money paid for their land and houses, but she had the utmost faith in her husband and allowed him to handle the money.

The husband hung around a few days after the transfer was made, when he informed his wife that he was going out of town for a few days on business. She accompanied him to the depot, and they parted in the most affectionate manner.

For some days no one suspected anything wrong, and even then their suspicions would not have been aroused had they not noticed old Mary hanging around the depot whenever a train came in.

Finally some one asked her where her husband was, and she replied that he would come home on the next train. A number of trains came in after that and old Mary was present every time and still the husband did not show up. Several citizens then took the matter up and began an investigation.

They discovered that the husband carried with him every cent of money possessed by the two, which amounted to several thousand dollars, leaving old Mary with nothing in the world but a small lot and shanty on the river banks. They could get no trace of the missing man, but it was evident that he had not only deserted his wife, but he had robbed her.

Knowing her keen affection for her husband, they broke the news to her as gently as possible, expecting to see her go off in a fainting fit or something of that kind; but she fooled them, for, after hearing their story through, she got up without a word, put on her hat, and announced that she was going to the depot to meet her husband.

She did not appear to be one of her mind, and she has not acted the part of an insane person since, except in that she will not believe her husband guilty of any wrong, although the evidence is very strong against him. Now comes the singular part of this sad story. Old Mary has not done a day's work in the past fifteen years, and no one knows where she gets the money to live on. Some have thought that her runaway husband sends her a few dollars monthly, but he could hardly do that and conceal his whereabouts, as old Mary would go to him if she could find him, even if she had to walk every step of the way.

All of her time is spent around the depot. She meets every train that comes in and she is as well acquainted with the time-tables as any railroad man about the place. She has not missed a train since her husband deserted her, and the same sad, heart-broken look comes over her face as the last passenger files out of the train. The railroad boys point her out as "the woman looking for a husband," but they all treat her with re-

MAJOR FRANK M... [handwritten: N.Y. Tribune ... 16 1891]

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MAJOR FRANK McLAUGHLIN.

an undertaking this was no one can understand who is unacquainted with the stream, deep and swift-flowing, and the unpropitious mountain ... basin destined to ... thousands ...

Jack Potter—I never won ... but once.

Bob Taylor—When was that?

Jack Potter—The last time I played poker. I saw a man who held four aces. Puck.

Not Stated by the Census.

Hardy—Did you know that the population of this country is declining?

Brown—I tell you it can't be so.

Hardy—True, though; they are declining to live anywhere else. Lowell Citizen.

Forethought.

"Our names are written in pencil in this marriage certificate," said Waldo Higgins, of Boston, to his Chicago bride.

"Yes," she said, "that's a Chicago custom. They are easier to rub out." Epoch.

BROOKLYN CLUBS.

Judge Clement, of the Brooklyn Club, is with his family at his country seat in Massachusetts.

The Lincoln Club is now in a flourishing condition and has a membership of 350, out of which there are but thirty-one bachelors.

The membership of the Montauk Club is rapidly increasing. Already forty names are now posted awaiting the action of the board of directors.

The report of the Hamilton Club, which has just been issued, shows the prosperity of the organization during the past year. The total membership is now 670.

The Unity Club is the name of a newly formed social and political organization in Brooklyn. The club took possession of its house on Cooper street last week. ... President Wilson, Charles A. Moore and ... A. Schieren, of the Union League Club, will shortly meet to formulate plans for the club to work on during the campaign.

President J. A. ..., of the Merry Bachelors Club, denies the stories issued concerning the financial embarrassment of his organization. ... to be merry ... old ... and will ...

The Columbian Club has taken possession of ... The house is open to members, though all the work of refitting is not finished. The formal opening of the club will take place early in the Fall.

The Home Club, one of the newly organized clubs in Brooklyn, took possession of its new clubhouse in Grand street ... last week. It was formerly the old Cabble mansion, and has been entirely re-altered and furnished handsomely.

One of the most active men in club circles in Brooklyn is Mr. Edward ... of the Montauk Club. He is a charter member of that organization, a three year director and is on the Building Committee which has done so much toward the completion of the present magnificent clubhouse. When in town he is a frequent visitor at the club. Mr. ... has closed up his house on Berkeley place for the summer and is now domiciled with his family at his country villa Sea Rest, Monmouth Beach, N. J.

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WORLD: SUNDAY, NOVEMBER 17, 1889.

WIZARD EDISON AT HOME.

WHAT THE FAMOUS INVENTOR EATS, DRINKS, THINKS AND LIKES.

A MAN OF VERY SIMPLE TASTES.

CARELESSLY DRESSED, A LITTLE DEAF AND A TIRELESS WORKER.

A "World" Reporter Spends a Day with Mr. Edison in His Magic Workshop at Llewellyn Park—Fond of the Theatre but No Use for Religion—He Confidently Expects to Live to Be Ninety Years Old.

Nine out of ten thoughtful Americans who should sit down, pencil in hand, to make a list of the men of the hour would write first, in a jiffy, the name of Tom Edison.

His history would make a story of rare interest in itself. That a peanut boy on a Michigan railway train should have brains enough under his cap to fool Dame Nature and bring all the world of scientists flocking to learn tricks of him is something. That a wandering telegraph operator, happy-go-lucky, here to-day and gone to-morrow, should have chained and trained the subtlest of nature's agents to his bidding, set slow-going precedent by the ears and gained the adulation and reverence of a world full of people is marvellous.

THOMAS A. EDISON.

The telegraphic business fairly echoes with anecdotes of Tom Edison. His history, his sayings, his doings, his odd ways and his wondrous expertness are among the traditions of the craft. They will tell you, in hundreds of offices the country over, how he was discharged from the office in Memphis because a manager concluded he was crazy and was not a fit man to be trusted with the company's business.

The story of his walking into the Boston office arrayed in a linen duster, asking for a job, being set to receive from the heavy-laden New

solemn, like an owl's. Let som body crack a
joke and in an instant, if you'd look at that
face, you wouldn't know it was the same Edison.
When he is in his inevitable suit of black, and
adorned with a little white law n cravat, you
might take him for a preacher if it were not for
his face. But in his smock fro k you would
have hard work guessing what he was.

With this gingham institution flapping about
his heels, the inventor goes stu mping around
from room to room in the gre at laboratory,
overseeing the different experim ents that his
assistants are conducting. He has the same
little stoop at the hips that ploug hmen acquire,
but he walks rapidly. There are between fifty
and one hundred men there, enga ged merely in
experimenting, at his bidding, and reporting
the results minutely to him. Ea ch experiment
is conducted in a room apart, bu t Edison never
loses track of one. He holds in mind, while
bossing them all, exact rememb rance of how far
each had progressed, what the la st results and
indications reported to him we re, what his directions
and what to expect fr om them at the
next visit. In the experiment room, as elsewhere,
he is a wonderfully observ ant man. He
believes a good part of invent ion consists in
catching nature at her pranks.

The slightest tricks of electricit y have resulted
in some of the greatest improve ments in telegraphy,
and from past experience he has learned
a watchfulness which absolutely sticks out all
over him. Edison's movements ar e at once quick
and deliberate. There is no ner vous yielding.
His purposes are long ones, but in a way he is
the most spasmodic of men. To the fellow who
works by fits and starts Ediso n's success is
comforting, when a million old fogies are rehearsing
the story of the tortoise and the hare.

AN EXTREMELY ACTIVE MIND.

There is something mercurial in his way of
work. He flies from one thing to another, and,
his workmen say, tires quickly of anything. Then
it is long odds he will order it m oved out of the
way until his interest in it is re freshed by rest
and absence from it. Meantime it will set with
a feverish energy about someth ing else. But
Edison is like electricity itself. No one can tell
what he will do next. At times he will take a
fad in his head that some work must be done
nights. Then he will tell the experimenters
they are a lazy lot of chaps and it's got to stop.
He will order them all to repo rt early in the
evening, and chances are they'll sit around all
night and do little or nothing. By the third
night they'll do nothing at all except eat lunch
and tell funny stories, and th e bit of
energy and the scheme of night-w ork will have
died natural deaths.

At other times the persistenc e with which
Edison works and keeps those ab out him working
is something unparalleled save in the
histories of great wars and grea t newspapers.
If he gets especially interested in an experiment
he will never leave the building for days. He
works night and day with a meag re allowance of
sleep that would throw an ordina ry man under
such a mental strain as his into b rain fever.

His meals at such times are br ought to the
laboratory, either from his hous e five minutes
distant or from the little hotel at the foot of the
hill, a stone's throw or so from the works. He
eats at the bench and works stead ily meantime.
What is brought him to eat he doesn't care so
long as pie is included. There are the times
when he accomplishes wonders in the way of
keeping awake. Frequently he has spent five
days and nights in the laborator y, "debarred
from the luxuries of baths and barbers and
toilet water," working constantl y and snatching
altogether maybe three hou rs of sleep in
forty-eight. In his room in the laboratory he
has a reclining chair and in the i ntervals of his
task, while waiting for a piece of lathe work
necessary to his experiment, he lie s down and in
a second is fast asleep.

Edison's argument is that so long as he can
continue to do that his nerves are unharmed.
Such sleep of twenty minutes or h alf an hour at a
time he holds to be just as goo d, so far as it
goes, as sleep taken under more favorable conditions.
He is a man of marvellou s recuperative
force, and says a half hour's sleep in the middle
of an experiment will clear his he ad as rain does
an overladen atmosphere.

GLAD OF A LONG SLEEP.

But when the experiment is o ver, when the
problem is solved, then the grea t Edison goes
home to his beautiful Glenmont, up on the hill
near by, and goes to bed and sle eps until every
lost minute is made up. Someti mes he is snoring
away for sixteen, eighteen or even twenty-four
hours at a stretch. It is his doctrine that
nature justifies her own balance in the matter
of sleep.

gorge themselves. There's too much eating done. Why, I never eat these heavy dinners. If I did I'd be a miserable, helpless, gouty, old dyspeptic. That's what broke me up in France. They stuffed me with big dinners and I couldn't carry 'em. At home I'm a very light eater. For breakfast I eat a couple of eggs and a little slice of ham, with two or three slices of toast and some tea or coffee; and for lunch and dinner about the same.

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"Besides your reading, Mr. Edison, what do you do for amusement?"

"Oh, nothing much. I like to laugh, and I don't care for dancing, and I don't like a crowd, especially if I can't hide myself in it. I do like a good story, and I like the theatre. I go quite often and would enjoy it immensely if I could hear what the actors say, but I can't. I'll tell you. My best hold in the theatre is the light opera. There's where I get the fun. I can go there, you see, and get down in the bald-heads' neighborhood and hear the music first rate."

"Then you are fond of music?"

"Yes, indeed."

"Do you sing?"

TELEPHONES RUINED HIS VOICE.

"Well, I used to sing, but I ruined my voice experimenting. I was trying for so many years to get an intelligible sound through my telephone. I succeeded. They tell me nobody else does. But, then, I busted my larynx in the effort," and the inventor laughed at his pleasantry. In the way of exercise Edison says he does nothing at all save now and then to walk home, which takes about five minutes. "I don't feel the lack of exercise," he said. "Why should I do bodily work when I don't need it?"

He keeps half a dozen horses, but does little or no riding for pleasure. "Are you fond of horses?" I asked him.

"No. I think they're a poor motor. They're a necessary evil. I keep 'em because I have to, and there isn't a fast one among 'em. I have come near being killed twice, and I don't consider horses safe. I like a motor with a governor on it. You listen to me. In twenty-five years from now electricity will have superseded horse power in New York in the performance of every sort of needful work. The horse will have become a luxury, a toy and a pet."

"Mr. Edison, what is your object in life?

MAJOR FRANK M'LAUGHLIN.

N.Y. Tribune Aug. 16-1891

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1072

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an undertaking this was no one can understand who is unacquainted with the stream, deep and swift-flowing, and the unpropitious mountainous country surrounding the basin destined to be robbed of its treasure. Not thousands but hundreds of thousands of dollars were needed for the completion of such an enterprise. Major McLaughlin's ability was fully equal to this call upon it; he went to London and raised the money in short order. The success of this attempt alone after weeks or months of effort would stamp the man who accomplished it as one of unusual enterprise, energy, tact and address. What then shall be said when it is told that within three days after the Major's arrival in England half a million sterling was pledged to his project?

Major McLaughlin, who was a New-Yorker originally, displayed athletic prowess in youth, but ambition and the cares of his immense business enterprises have long since taken him out of the ranks of active competitors. He excelled as a boxer, being at one time "Billy" Edward's "crack" pupil. Major McLaughlin is now a director of the California Athletic Club, an organization composed in the main of wealthy men, who believe in encouraging athletics by giving large purses for champion boxers to compete. It is from this California Athletic Club that the present encouragement of high-class boxing comes; all other like organizations being laid out upon its lines.

York wire and putting the sender to blush, is one of the stock yarns told by operators of all ages. The telegraph operator glories in Edison as a fellow and in some measure appropriates a share of the great man's greatness. They consider him indisputable proof that some good can come out of Nazareth. He has "got there." He can dictate terms to the biggest, fattest, most robust corporation on earth, and his brain is a mine which no combination of capitalists can open against his will, and the wealth of which he can carry away to eternity with him if he pleases.

EDISON AS HE IS.

I want to make a pen picture of Edison as he appears at the age of forty-five, in the rich prime of his years and at the zenith of his accomplishment. He is most attractive just at this hour, with his great triumphs all behind him, and yet standing, as he says, merely at the threshold of electrical invention. To do it I have made a trip or two to the phonographic laboratories, a mile or so from Orange, in the Democratic and apple-Jacksonian State of Jersey. It is two years since Edison and the Edison interests took lodgement at what is known as Llewellyn Park, but now the personality of the wizard is over the neighborhood like the legendary "cloud by day and pillar of fire by night."

Without meaning to do it, maybe without knowing it, he broods over the vicinity like a small Electromotor Buddha. In the surroundings of his laboratory is an air of mystery. The incomprehensibility of something or other obtrudes upon every one. The neighbors look reverently at the big brick buildings, in respect to the juggling and necromancy that are taking place within.

There is an intimation of brains in the air, and the visitor's estimate of himself is sadly dwarfed by the sense of nearness to genius. But the folk who have lived for a year or two under the shadow of the wizard don't fear him in the least. They find him a wholesouled, frank, outspoken man, cast in the common mould, who minds his own business and is no crank at all, is cheery to every one he meets, hasn't a swelled head, and says what he has to say in language they can understand.

HIS LABORATORY.

The laboratory is a big red brick building or group of buildings three stories high, with blank, mocking windows, from which come strange sounds, bursts of fitful music and wild cries, until the listener is quite convinced that nature is undergoing the inquisition up there, sure enough. The entrances are shut from the street by a long fence with pickets of enormous height and breadth. When you have stood long enough before the white-paled fence you press a button at the gate, and a boy who is sadly in need of a little electricity saunters out to admit you. You wait in an enormous library full of scientific books, written in divers tongues. But to get to the Wizard is like running a blockade. He is immured somewhere up in the labyrinth, and, besides passing the guards, you must thread many mazes amongst instruments of strange design, of glass, of gutta percha, of all the metals, before you find him.

Here in these great buildings of brick is Edison's life. Here, more and more, his ambitions are centring. The laboratories were erected for work upon the phonograph, which has been and is the darling of his heart. And save when some business or social duty—of the latter he acknowledges few—calls him away, here you may find him at almost any hour.

He is a strange figure, in his long frock of checked gingham, which buttons close at the chin and reaches to the heels. It is nothing more nor less than a man's Mother Hubbard, which Edison pulls on when at work to protect his neat suit of black broadcloth from dust and acids and oils and edged tools. A big head, with straggling hair, just turning gray, and a big face that has a queer something more than Yankee shrewdness in it, loom above this peculiar garment with strange effect. Edison in his working gown is a sight to laugh at, until you remember that it is Edison. Still there is nothing of the rapt genius about him to repel the visitor or impress him with a sense of his own littleness. Edison is bluff and hearty, and his enormous mouth grins as easily as can be. He speaks in a loud tone and scolds his assistants in a brusque way for their idleness, when they know he doesn't mean it.

IN ROBUST HEALTH.

The lean telegraph operator has grown fat in these latter years, not so much upon high living as upon high thinking and for lack of bodily exercise. He has the action and vitality of a robust, healthy man. He is broad of shoulder and deep of chest, but there is a pallor about his face, caused, beyond question, by prolonged confinement within doors. His nose is the color centre, as well as the geometrical centre of his face, but its ruddiness is not an alcoholic growth. There never was an eye just like Edison's. It is of cold color, that a strict critic might call fishy, but it is an inquisitive eye, and all about it are the wrinkles which nothing but years of genial laughter can impart. Altogether, it is a face among a thousand. In repose it is sadly

"The customary hours of work at the laboratory, though, are from 8 or 9 o'clock in the morning, when the Wizard puts in an appearance, to 6 at night. When he is not working on "double time," Mr. Edison spends most of his evenings reading at home, where he has a library fully as well stocked as the great scientific one at the laboratory. He is a voracious reader, but of a necessity nearly all his reading is done in the sphere of his own work. If it were not he couldn't keep pace with the business. He is a subscriber to all the technical publications extant bearing upon his line of work and reads them all, including the foreign ones, besides scanning carefully the daily papers, for Edison is a man of affairs as well as a scientist. He considers French easy and calls German a "gymnastic language." But he makes no effort to speak either one.

Just now, after so many weeks spent junketing abroad—though he says he was studying with his eyes and ears all the time—Inventor Edison is the busiest man going. He stays close at home, coming only to New York for some business of much moment, or for some social enjoyment that he thinks unusually tempting. The other night he sat beside ex-Governor Tom Waller, of Connecticut, at the Fellowcraft Club dinner, and his face was a study when Bill Nye stood up before the 200 guests and congratulated him on being a "rising young man." He says Nye is the living image of a renowned chemist he met in France.

The Fellowcraft diners would have given a good deal to get a few words out of Edison, and rosy-faced ex-Consul Waller nudged him and told him a speech was the proper thing, but the inventor hung his head and laughed and cried, "No! no!" and with both hands waved the 200 clamorous ones away, as Cæsar did the crown. I spoke to him about it afterwards in the laboratory at Llewellyn Park. "Goodness!" he said, "I'd like to have said something, but I couldn't think of a thing. I can talk to two or three and can talk an arm off almost any man, but when it comes to a crowd I'm dumb as well as deaf."

When I called at Llewellyn Park Edison had his nose deep in the pages of an enormous book, and half a dozen more were strewn about him. Their pages were filled with cuts and diagrams and algebraical formulæ and abtruse reports of experiments. He was "plugging," as college boys say, "for dear life."

HIS DEFECTIVE HEARING.

Edison is too deaf for any comfort. When he listens he cocks his head at an angle and twists his face into a funny expression of attention, as if every muscle was being employed to concentrate the sound upon his tympanum. One tribute he will not, seemingly, pay to invention—that is, to use an audiphone. He just scoops one hand over his better ear and waits. There is something quizzical in his face while he is waiting to learn your business. If it happens to be newspaper business there is not a man living who will make you more at home in two minutes than will he. A great many smaller men might learn that lesson from him. "I class newspaper reporters—mind you, I mean American newspaper reporters"—he said, in answer to a question, "with telegraph operators. I think they belong to the class of good fellows, and that's really as good a thing as I can say for a man. As for the foreign newspaper reporter, I didn't find one there—at least, not on the Continent. They have no daily newspapers—merely daily papers. By the way, that *Figaro* is the greatest institution of its kind I ever saw."

Edison is very plain of speech and interlards his talk with the technical expressions with which he has constantly to deal in the realm of his business. When told that THE WORLD wanted to publish something about him personally, he grinned a broad, modest grin and said: "Gracious! There isn't anything to say about me. More space has been wasted on me already than I'm worth."

"But THE WORLD wants to tell folks, not what new scheme you have on the tapis, not what you are doing, but rather what kind of a fellow you are that does it, how hard you work, how you stand it and what kind of care you take of your health."

CARELESS OF HIS HEALTH.

"Not much," he answered, laughing; "it takes care of itself. So long as I feel good, which I do, I don't see any use of worrying or of changing my habits of living. Most men would say they couldn't live as I do and keep well. They want eight hours of sleep. I can get along for six months without ever getting a wink more than four hours, and I feel better for it, too. The benefits, you see, that are to be got out of sleep depend on the quality of the sleep. When I only sleep four hours the sleep is so much deeper and stronger, and dreamless and refreshing. The man who wastes his time lying abed never sleeps soundly. Any little noise wakes him. Then he turns over and groans, and dozes again. That is not rest; it's restlessness.

"Why, when I lie down here in the laboratory to sleep for four hours I sleep for four hours, and all the lathes and pounding and planing and testing that can be done won't waken me. I'd give odds against the thunders of Sinai doing it, until the time came that I had set for getting up. My mind is my only alarm clock. I set it before going to sleep, and it never fails of its business. When I sleep four hours a night I wake up with mind and body alert. I want to run upstairs three steps at a time, and feel as if I could make a pretty good show with Sullivan. But eight hours' sleep makes me lazy and stuffy and useless.

"I don't believe, though, that most folks stop to think how closely eating and sleeping are inter-related. The reason that more men can't get along with four hours' sleep is that they

What are you living for? What do you want?"

At this question the inventor's lower jaw fell, he laughed and breathed once like a man who had been hit a smart rap in the pit of the stomach. Then he began to inspect the ceiling of the room. Then he wheeled his chair around and stared out of the window at the houses on the hillside, dim through the dismal rain.

"Hm! Do you know," said he, "that I don't believe I ever thought of that, in just that way, in my life? That's quite a thing." Then he thought some more and said: "I can't exactly answer that. But I guess all I want now is to have a big laboratory, and just as long as I can to keep on experimenting and making useful inventions and having them successful. But there isn't a bit of philanthropy in it. Anything that won't sell I don't want to invent, because anything that won't sell hasn't reached the acme of success. Its sale is proof of its utility, and utility is success."

This practical side of Edison is shown in a thousand ways and a thousand happenings. He has no time for moralizing. How many men would have answered as he did when asked their life's object? The picture was a strong one. A man, master of health, wealth, influence, a happy as well as a beautiful home, with fame world wide and power not only among men but among the elements, with the sense of having led the human race a long stride towards the light of knowledge, a man whose mental ear is nearer, may be, to Nature's lips than that of any man living—this man sits, even more to be marvelled at than Alexander of old, and wonders what he wants.

NO USE FOR RELIGION.

Some people find solace in religion. I asked Mr. Edison what his creed was. "Oh, I have none," he answered. "I don't feel that it's a necessity, and I never get much more than ten feet above the earth. I think all religions are good—for the people who embrace them. The Catholic is as good for the Catholics as the Protestant is for the Protestants. But, for me, I have no use for either. I think everybody'll be saved, but I think the civil authorities the most potent correction influence. I think with Carlyle that the police are the best promoters of public virtue."

"You believe in God?"

"Oh, yes; I think all scientific men do that. Or, rather, they don't believe it, they *know* it. It is for the masses to believe. The scientist *knows*. When it gets down to earth, though, to a doctrine of atonement and plan of salvation and question of ritual, I'm not in it.

"I don't go to church much. You see, I'm deaf and can't hear the sermon. And that's the best kind of an excuse," said Mr. Edison, laughing. Then I asked him for his list of requisites for success. These are what he gave: A good imagination coupled with a lot of horse sense, great application and absolute determination never to be discouraged.

The reason, he says, that the gaining of wealth has grown to be termed success is that to ninety-nine men out of one hundred it is the only avenue open.

Mr. Edison, now for the second time married, is father of four children, the eldest, a daughter, being now absent in Europe. Their home, Glenmont, is delightfully situated on the hillside a little way from the laboratory. It was purchased by Mr. Edison from Arnold, Constable & Co., who took it in justification of their claim against one of their agents. The house is a lovely one and commands a far view of the valley. He is a home man and spends most of his leisure there.

TALES OF THE INVENTOR.

About Orange you can hear numberless stories of Edison. Everybody likes him. One man who had been for years in his employ as an experimentalist told of a visit a number of capitalists, including Jay Gould, Sidney Dillon, Sam Sloan and Cyrus Field, paid to Edison at his laboratory one day, to inspect the workings of some induction experiment in devising the scheme for telegraphing to moving trains. Edison came out of his workroom, where he was busy, and shook hands with Mr. Field. At that instant something popped into his head apropos of the experiment he was at work on. He never gives an idea time to escape him. Without a word of excuse to the four magnates he turned on his heel and hurried into his den again. They waited and waited, and by and by, tired out with delay, wended their way downstairs. Shortly afterwards Edison came out and asked, "Where did those paupers go?"

"Downstairs."

"Did they walk?"

"Yes."

"That's right. I don't want 'em to wear the oil off my elevator." Then he stood around for an hour and swapped stories with the men in the shop. He is the greatest man living for stories, and it is a tradition among his employees that they can tell him the same story every day for a week and he'll never tire of it, nor in fact show any sign of having heard it before.

In politics Edison is a Republican, but not a soul of all those about him can tell you when he last voted.

AJOR FRANK M'LAUGHLIN.

ibune ———— Aug. 16 1891

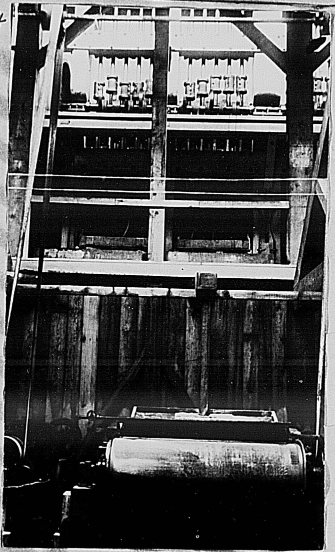
ES TO HANDLE RIVERS AND BOXING
CONTESTS.

ost widely known and certainly the most
member of the famous California Athletic
jor Frank McLaughlin, a picture of whom
rewith. Major McLaughlin is a millionaire
his money in mining; not in the ordinary
t by one marvellous stroke. Nuggets have
d, rich mines developed, and all sorts of
ut through for the despoliation of nature of
us metals, but it remained for Major Mc-
to turn a mighty river from its bed, and
rately help himself and the company behind
e treasures the mountain streams had been
centuries washing down from the hillsides
lting in this central basin. The genial
ned aside from its course by means of huge
Feather River at Oroville, Cal. Just what

MAJOR FRANK McLAUGHLIN.

rtaking this was no one can un-
who is unacquainted with the stream, deep
-flowing, and the unpropitious moun-
ountry surrounding the basin destined to
d of its treasure. Not thousands
eds of thousands of dollars were needed for
ction of such an enterprise. Major Mc-
ability was fully equal to this call upon it;
London and raised the money in short order.
s of this attempt alone after weeks or months
ould stamp the man who accomplished it as
nsual enterprise, energy, tact and address,
shall be said when it is told that within three
the Major's arrival in England half a million
s pledged to his project?
cLaughlin, who was a New-Yorker originally,
thletic prowess in youth, but ambition and
f his immense business enterprises have long
him out of the ranks of active competitors.
l as a boxer, being at one time "Billy" Ed-
ack" pupil. Major McLaughlin is now a
f the California Athletic Club, an organ-
mposed in the main of wealthy men, who
encouraging athletics by giving large purses
on boxers to compete. It is from this Cali-
letic Club that the present encouragement
s boxing comes, all other like organizations
out upon its lines.

2504



2506

The Montana Club

extends to Mr. Chas Batchelor

at the request of Mr. C W Cannon

the privileges of the Club for

the period of ten days from date

[illegible]

Secretary

Helena July 19 1890

2507

Mount Hamilton Stage Company

DAILY LINE TO LICK OBSERVATORY

Office. No. 8 N. First St., San Jose. Cal'a.

Parties desirous of visiting the Lick Observatory will please leave word with the clerk of the Hotel at which they are stopping or at the office of the Company. Our Agent will visit each Hotel in the evening to book passengers for the next morning. Observation Coaches. Careful Drivers. Fast Time. Perfect Safety

ALL PASSENGERS ARE LOCATED BY CHART OF SEATS IN COACHES.

GOLDWIN BROWN, Assistant Agent.

F. P. CHILDS, Agent.

2508

Charles Batchelor Scrapbook, Cat. 1244

This scrapbook covers the period June 1881-July 1882 and contains letters and cables primarily between Edison and Batchelor. A few of the cables are signed by Sherburne B. Eaton and Samuel Insull. Many of the cables relate to the Paris Electrical Exhibition of 1881 and to the establishment of electric light companies and central stations in Europe. Some letters concern the marketing and shipping of dynamos, lamps, and related equipment. There are also communications between Edison light companies and their agents. The front cover is labeled "Letters and Telegrams from T. A. Edison, S. B. Eaton." The spine is labeled "Cables." The scrapbook, which was disbound prior to microfilming, contains approximately 120 pages. The first 31 pages are numbered, while the remainder are unnumbered. Copies of most of the cables can be found on the microfilm in Letterbook, LM-001 (Letterbook Series). These cables have not been refilmed.

Letters and Telegrams

from

T. A. Edison. T. B. Caron.

les.

Letters and Telegrams
from
T. A. Edison, T. B. Caton.

Mr. Batchelor,

Shall not be able to get samples of Iron made from the sea shore sand for a week or ten days as it will have to be cast at the furnace.

Please do not forget to take with you a copy of the specifications of Babcock & Wilcox for their boiler which has been shipped. Among other things they provide that they shall pay the wages of their man to erect the boiler but that we shall pay his expenses. We have also got to furnish brick &c.

S. B. Eaton

per Mc. G.

June 17th. 1881.

The Edison Electric Illuminating Company of New York.
65 Fifth Avenue.

New York, July 18 1881.

Charles Batchelor, Esq

Dear Sir:

I enclose herewith the agreements with Leon. They are three in number as follows:

(1) March 9, 1881, between Leon and Puskas & Bailey
(2) June 8 " " Leon and The Edison Electric Light Co. of Europe.
(3) June 6 " " Leon and Puskas & Bailey.

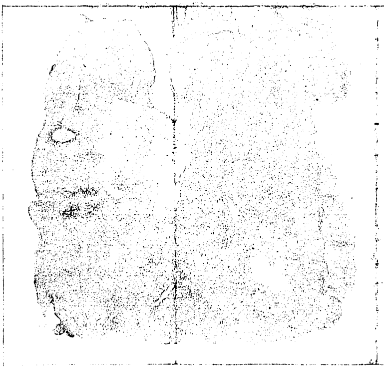
The first agreement was made between Leon and Puskas & Bailey and contained a provision the Puskas & Bailey should deposit 1000 shares of stock as security. This agreement was submitted to us for our approval and confirmation. Our Directors, however, refused to confirm it, preferring that the Company should deal directly with Mr. Leon. The Agreement No 2 was accordingly prepared and submitted to Mr. Leon and has been executed. This is the agreement between the Co. and Leon.

Leon, however, was not satisfied and insisted on a modification of the words "if the light as exhibited

proves a success", and accordingly made another contract with Puskas & Bailey, restoring the security of 1000 shares on their part and modifying the words above quoted. These three agreements form the whole history of the contract.

I also enclose printed copy of your testimony.

Yours truly
Wm. H. Meadowcroft



Eaton
July 18

[SEPTEMBER 14, 1881]

Le port est gratuit.
Le facteur doit remettre un récépissé à souche lorsqu'il est chargé de recouvrer une taxe

Télégramme.

Indications de service.

Brest 2

CR TR FS

N°

Timbre à date.

BATCHELOR .+ PARIS .

Pour PARIS MENLOPARK NJ . 328 91 V Mots Dépôt le à h. m. du

.+ VVE VVANT FIVE PER CENT FOR OUR SELVES ADDED TO ALL FOR OURSELVES ADDED TO ALL GOODS MANUFACTURED FIRST TEN YEARS VVE AGREEING TO GIVE ALL PLANS AND IMPROVEMENTS IN MANUFACTURING MACHINERY DURING THAT TIME FROM OUR VVORKS HERE AND PUT VVHOLE IN OPERATION VVILL SHIP THREE DYNAMOS ON TVVENTIETH FOUR ON TVVENTY SEVENTH BEST CAN DO LAMPS GO NEXT VVEEK DO YOU VVANT SOCKETS BIG DYNAMO SAILED SEVENTH MAILED FULL INSTRUCTIONS TENTH NO INDUCEMENT GIVEN ABORTION YOU BETTER SEE HIM ARRANGE IF NECESSARY IMPRESSION

2

Le port est gratuit.
Le facteur doit remettre un récépissé à souche lorsqu'il est chargé de recouvrer une taxe

Télégramme.

CR TR FS

N°

Timbre à date.

VVAS THAT ABOVE RETAINED HIM .+ EKNOSIDE .

Pour de N° Mots Dépôt le à h. m. du

Janvier 1881. — Modèle n° 324 Fr.

Le port est gratuit.
Le facteur doit remettre un récépissé à souche lorsqu'il est chargé de recouvrer une taxe.

N°

65 Fifth Ave New York
19th September 1881

My Dear Batch

I shipped you six meters some days back. You had better do nothing more than show them. Fill them with blue vitriol and let them stand. Do not attempt to weigh the plates as it is a very delicate job and will cause you considerable trouble. I have got a Cigar Lighter which will be sent you shortly. You may have to change the size of the platinum wires. Bergmann has been about ~~6~~ four months making the revolving arc lamp and it is not done yet. If done in any reasonable time will send them to you

The Dynamo with radial bars is not done yet. I stopped making a large machine and am making a smaller one & will endeavour to send it to you. Try and get it brought prominently out in one of the Scientific papers as a new and novel Dynamo constructed on entirely new principles and have it illustrated ~~as~~ in the Patents where you

2/

will find how the connections are made.

I suppose if you get the Contract for lighting the whole of the Grand Opera House you had better have Steam Dynamos sent you of the new type and the best plan will be not to try to use the big Dynamo you have for this purpose but to ship that to England to act as a spare machine for Johnson. I shall be able to give you all the Steam Dynamos you want by the end of December.

Regarding the European Company what I am trying to do is to have a large Syndicate formed in Paris or elsewhere by Fabbri Puskas & Bailey, or anyone else which Syndicate is to form a Parent Company for operating the Light on the Continent of Europe and to prevent this new Coy from being a purely speculative one I propose that the Company shall pay up one million of dollars for the purpose of forming a large Manufacturing Coy for making lamps Dynamos, Engines, Tubes, Chandeliers and all appliances connected with

3/

Electric Lighting and the proposition is ~~that~~ the Company shall be formed Capital Twenty million dollars of which one million dollars is to be paid the present European Co in cash and nine million dollars stock. So it would amount to two million dollars of stock being sold one of which goes as I have said to the European Company and the other million to be subscribed to the Stock of the Construction Company. This is the natural thing to do and Puskas agrees with me in this opinion. It may be that we cannot swing such a large amount but still I believe the longer we hold on the more likely we are to get it. With one million dollars in the Construction Coy run by our men and started by us we having absolute control the first year there would not be any doubt about the technical success of the enterprise and if the technical success is assured the commercial success would naturally follow and the whole thing would be ~~a success~~ while most inventions

4

sent over there have been just the opposite. In my telegram of today I spoke of 5% to be given us. What I mean by that is that we are to supervise and start all the factories and put them in operation and furnish all duplicate drawings and have constructed (at cost of Const^n Co) here or on the other side all the special machinery and to give all improvements which we devise in our works here and of which the European Const^n Co would equally get the benefit. We should have to start and supervise the manufactory in other Countries than France where under the Patent law we are compelled to manufacture within the Countries themselves. For all this it is but fair that we should receive 5% ~~added~~ calculated on the actual cost of the goods which should be paid us from the date when the first goods are turned out, we agreeing to turn over the factories to persons competent to do the work when our connection ceases that is except so far as the 5% are concerned. This sum is to

5

reimburse us for our time and experiments on this side, our drawings and experience and you will easily see that this will be a great bargain for the Constn Co as in finding out what we have learned the cost of experimenting to them would be more than five times what they pay us.

As to the Installation of these various works I shall have to depend on you entirely. You can have what men you want that we can spare and as to the division of the 5% I would make that perfectly satisfactory to you

The life of the lamps are very much longer than I ever expected I have not seen the record for the last few days but the last I saw the life of the 8½ per electrical horsepower was 1900 hours with a average of 1800 hours while the ten per electrical horse power were 1300 hours with an average life of some what over 700 hours: three lamps of each kind are still running but we are making very much better lamps now as we have curves a148

6

13 Sept, Edison to Batch

candles in which the average life was 94 hours and the longest life of any one lamp was 204 hours at 48 candles. This was a 8½ per horse power set. The average life of the ten per horse power lamps is enormously less at 48 candles. But the lamps on which we are making the 16 candle record only had an average life of 12 hours at 48 candles. Since that time we have curves with the ten per horse power lamps with an average life of 22 ~~candles~~ hours at 48 candles.

¶ I suppose you will have some trouble soon on the other side in getting people to believe the statement that the average life our ten per horse power lamps is 800 hours because there is no way to prove it. I suggest that you take the earliest opportunity to put up ten lamps of the lowest volts in a box with glass front having same sealed and start them going at 16 candles. Have a responsible person to seal the box and certify the burning times & he should be

V

a man whom everybody has confidence in. Whether you can get such a chance I do not know but it is possible you might in the Cellar of the Grand Opera House when you make the installation there At any rate I personally will guarantee any contract, with a penalty of twenty thousand dollars ($20000) to put up twenty five thousand lamps (25000) in any City in Europe, the said guarantee being that if the lamps do not average a life of seven hundred hours (700) with ten lamps per electrical horse power said lamps giving sixteen candles illumination I will forfeit the sum above named. #

Let me know if they are going to make a test as to the efficiency of the Dynamos. If so use the Copper Rod Dynamo as you will doubtless get about 95% efficiency out of it. I should take out of it from nine to ten horse power. That will give you the best efficiency. Use plenty of space around your Dynamo Brushes. It is a splendid thing

8/

Put on a thin coat each night in between the wires or in the case of the small disc Dynamo paint around and over the bars and the discs at the end. It gets very hard and is a splendid Insulator.

I have just thought that the Dynamo I sent you is wound in a different way with a even number of commutators and I have not sent you any description how to wind them. I wrote you previously that I had sent you a lot of wire so that Martin Force can wind the Armatures. By next steamer I will have a model sent you showing how to wind them. You know the greatest difference of electro motive force is between any two layers of wire and as it is somewhat difficult to insulate each layer separately by itself in the old way of winding we have divided the bobbin into half the number of spaces making each space twice as wide. Now we wind each space half full going square round the machine; then we insulate the whole of the

9/

bobin and wind around again over the top. This keeps the coils which have the greatest difference of potential and tend to cross one above the other instead of side by side. Thus we are enabled to get a good insulation between these coils, but to do this we had to use an even number of coils and commutators. I will send you a wooden bobin in which the first layer is shown in white thread and the second layer with black or red thread (I do not remember which was). I have started a new way of dealing with men now whom we are sending away say to ~~South~~ America. I make them wind ~~two~~ two complete armatures before they can go and then instead of sending an extra armature I only send wire so that if they break down they can easily rewind the ~~ma~~ armature.

Please let me know what are the legal results of the examination of my patents in France and also what is my legal status in England if anything has been done there by

way of examination.

We cannot find that Swan ever published anything showing that he ever experimented upon a filament of carbon in high vacuo in a chamber made of glass, nor can we find any patents until after our patents were issued on such a device. Do you know anything to the contrary.

Do you believe it would be possible to get the writers of "Engineer" & "Engineering" on our side and what would be the best way to go about it. Would money in the form of a fee for an opinion on the validity of our patents as against Swan, Lane Fox, & Maxim be ~~the right method~~

I hope you have got the Roman Letter Automatic working as I am sure it would be very striking. It worked very beautifully here—in fact quite astonished me

With reference to "Abbott" I offered to pay his way over to Paris & back which he said would amount to £2000, a few days before he sailed he told me he had come to the conclusion that he had better

IV

not: he would rather go untrammeled and free to do anything and even if he accepted he would consider himself untrammelled. My impression is that he was bought off and hired by Maxims Co, although I may be mistaken in this. You may be able to tell however by hearing what he says to others where his interests are. It is impossible to tell by talking to him. He is a very deceptive man

Very Sincerely Yours

T. A. Edison

Since writing above have received following

Test Lamps

Life and Average Sept 12th 9 a.m.

Elect. H. P.	Still burning	at hours	Average hours
8½	3	1846	1237
10	3	1339	728
20 (half lamps)	2	1154	590

½ Lamps were poor set

TAE

Edison's proposition

"Raise $300000 to establish factories immediately on success of large dynamo—
upon success of N.Y. station $400.000 more for factories' increase

of both sums the EEL&C. receive 51/100 fully paid shares of manufacturing Co out of which they pay Edison and B. for unpatented improvements

Syndicate to aid in financing companies throughout Europe

present EE&C Co giving them one fifth ~~proceeds~~ profits of isolated business to be divided equally between manufacturing and present European Co.

Syndicate shall from time to time and until profits come in advance money for litigation press etc to be paid out of first profits

...réception........ CR
...recommandé... TR
...faire suivre... FS

N°

Timbre à date.

PARIS
24 SEPT 81
CENTRAL

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.

L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

Pour Paris *de* Nyork *N°* 162 *Mots* 28 *Dépôt le* 24 Sept 24 1881 *à* ___ *h.* ___ *m. du* ___

See my cable Bailey suggesting new Basis
assist him in explaining small risk and
handsome profit from isolated to syndicate if
they accept this plan

Edison

[OCTOBER 11, 1881]

INDICATIONS DE SERVICE. 24 **Télégramme** TIMBRE À DATE.

Anglo

Pour ______ de New York Nº 206 Mots ~~180~~ Dépôt le 11 à __ h. __ m. du ______

Mr Ch. Batchelor 24 rue Berlioz Paris

Retain abrupt on behalf of actuated to pass upon merit validity and terms of contract also retain french lawyer data for engineers goes this week paris dynamo gave fourteen and

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.
L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

Janvier 1881. — Modèle nº 524.

INDICATIONS DE SERVICE. 2 **Télégramme** AV. GRANDE ARMÉE 52 11 OCT 81 PARIS TIMBRE À DATE.

Pour ______ de ______ Nº ______ Mots ______ Dépôt le ______ à __ h. __ m. du ______

seventy hundredths eight candle lamps per indicated horsepower english fifteen and seventy hundredths eight candle lamps i put in eight candle lamps as that is nearer gas jet we shall do better but wont guarantee until we do investment not exceed nine dollars per eight candle light actual burning at maximum season

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.
L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

Janvier 1881. — Modèle nº 524.

INDICATIONS DE SERVICE. 3 Télégramme. AV. GRANDE ARMÉE 11 OCT 81 PARIS TIMBRE À DATE.

Pour de . N° . Mots . Dépôt le à h. m. du

investment less than nine dollars in good district lamps being included in running expenses depreciation three percent on total investment consumers pay for wiring their own houses but after first station consumers of second station pay for service mains to houses in addition cost producing light will depend upon

Janvier 1881. — Modèle n° 324.

INDICATIONS DE SERVICE. 4 Télégramme. AV. GRANDE ARMÉE 11 OCT 81 PARIS TIMBRE À DATE.

Pour de . N° . Mots . Dépôt le à h. m. du

many conditions impossible make estimate except conditions known their engineers should do that cost will however be less than gas providing several stations are put in operation cost producing gas increases in rapid ratio competition reduces their total sales.

Ekdoside

Janvier 1881. — Modèle n° 324.

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.
L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

[JANUARY 27, 1882]

Indications de service.

Indications conventionnelles.

Avis télégraphique.......... AV. | Accusé de réception........ CR
Réponse payée............ RP | Télégramme recommandé.... TR
Télégramme collationné.... TC | Télégramme à faire suivre... FS

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.

L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

N°

Timbre à date.

27 JANV 82 PARIS

Pour ______ *de* New York *N°* 136 *Mots* 11 *Dépôt le* 27 *à* __ *h.* __ *m. du* __

Mailed twenty four at seventy remit will get balance

Bergmann

[MAY 19, 1882]

Indications conventionnelles.

Avis télégraphique	AV	Accusé de réception	CR
Réponse payée	RP	Télégramme recommandé	TR
Télégramme collationné	TC	Télégramme à faire suivre	FS

Dans les dépêches imprimées en caractères romains par l'appareil télégraphique, le premier nombre qui figure après le nom du lieu d'origine est un numéro d'ordre, le second indique le nombre des mots taxés, les autres désignent la date et l'heure de dépôt.

L'État n'est soumis à aucune responsabilité à raison du service de la correspondance privée par la voie télégraphique. (Loi du 29 novembre 1850, art. 6.)

Indications de service.

Brest

5

N°

Timbre à date.

Pour ______ de ______ N° ______ Mots ______ Dépôt le ______ à ______ h. ______ m. du ______

PARIS DE MENLOPARK 137 13 V ER

EUROPEAN ALVANCED TVVENTYFIVE IN FORTNIGHT VVILL YOU TAKE FIFTY AT SEVENTY MARKET STRONG - INSULL =

Janvier 1882.

FRANCIS R. UPTON COLLECTION, 1878-1918

The Francis R. Upton Collection contains the personal, laboratory, and business records of Francis Robbins Upton (1845-1921). Upton came to Menlo Park in late 1878 after studying physics at Princeton and in Berlin. He played a major role in the development of Edison's incandescent lighting system. Upton's papers were donated to the Edison National Historic Site in 1963 by Paul Kruesi, the son of Edison's longtime associate, John Kruesi. Kruesi had received the papers from Upton's daughter, Eleanor.

The collection encompasses the years 1878-1918 and comprises about 200 items. Among the earliest documents are three notebooks. One was kept by Upton during the summer of 1878 while he was a student of Hermann von Helmholtz. The others were used during the fall of 1878 while he was conducting a literature search for the Edison Electric Light Company. The remainder of the collection consists of correspondence and other unbound documents. Upton's correspondence from the period 1878-1880, written primarily to members of his family, is an invaluable source of information about the early stages of the incandescent lamp. The material from the mid-1880s through the 1890s deals primarily with the Edison Lamp Company, of which Upton was general manager. Included are numerous notes and memoranda concerning lamp manufacture. Several undated items at the end of the collection also date from this period. The post-1900 items include a note from Edison about the fire at the Edison Phonograph Works, Upton's notes about Edison for a speech at the first Edison Pioneers' meeting in 1918, and a membership list of the Pioneers.

The correspondence and other unbound documents have been arranged in chronological order. Undated documents to which no year could be assigned have been filmed in approximate chronological order at the end of the collection. All but a few items have been filmed. The unfilmed material includes a patent issued to Upton, several speeches and articles unrelated to Edison, photographs, and memorabilia.

The documents appear on the microfilm in the following order:

A. Notebooks (1878)

1. Student Notebook
2. Literature Search Notebook #1
3. Literature Search Notebook #2

B. Correspondence and Other Unbound Documents (1878-1918)

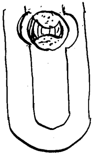
Francis R. Upton Student Notebook

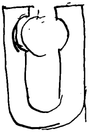
This notebook was used by Upton in June and July 1878 while he was a student of Hermann von Helmoltz. The book contains notes in German about Helmholtz's lectures on electricity and light. The notes are often accompanied by drawings and calculations. The front cover is labeled "E Helmoltz Upton 26/6 78." The pages are unnumbered. Approximately 50 pages have been used.

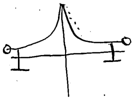
Den ~~7~~ 6 Juni

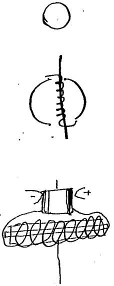
Los

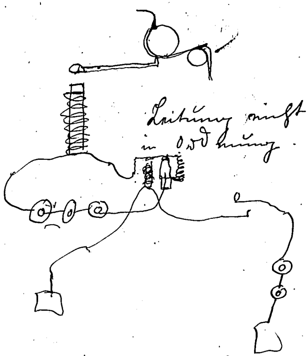
X-E6298







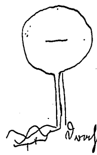




June 29

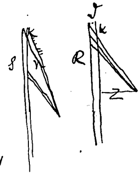
Wenn Komme Magnet Nadel

Helmholtz' Tangent Bussole



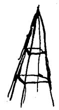
Drahte entfernt

$\frac{e f'}{r_1^2}$ e Dichtigkeit f' Fläche



$$\frac{e f'}{r_1^2} - \frac{e f''}{r_{11}^2}$$

$$\frac{K}{\vartheta} = \frac{R}{Z}$$



$$K =$$

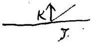
$$\varepsilon K 2\pi R = \frac{\varepsilon 2\pi R^2 \vartheta}{Z}$$

$\varepsilon \vartheta = \mu$ Magnet Moment

$$Kraft = \frac{2\pi R^2 \mu}{Z} \frac{Z}{(\sqrt{Z^2 + R^2})^3}$$

$$K = \frac{2\pi\mu}{R} \qquad Z\,\cancel{K}\,R$$

$$= \frac{2\pi I}{R}$$ Anziehende Kraft



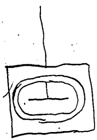
I fed Kraft im Maße.

$$\tan\alpha = \frac{K}{T} = \frac{2\pi I}{R T}$$

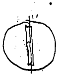
im absoluten Maße
genau genau mit Chemische
Zersetzung in Verhältniß

Model muß kurz

Spiegel 3 Meter
$3000 \div 50 \div 60$



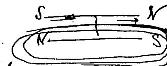
~~Fortgesetzt~~ in Luft



$$T k \mu = T \sin\alpha\, \mu$$

nicht so gut als dann

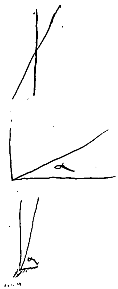
July 1



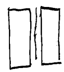
Das Rohr so zu stellen
Schwarz gegen parallel

Man kann bei starken
Orten unempfindlicher
empfindlich Luftströmen

A



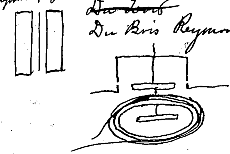
Die Draht sehr sehr oft.



Er magnet.
und anzieht.
wenn zu empfindlich

zu beseitigen
magnet?

~~Du Bois~~
Du Bois Reymond



$$\frac{\mathcal{E}\mathcal{E}}{r^2} = k = \frac{m\cdot(V_1 - V_0)}{t_1 - t_0}$$

$$\frac{\mathcal{E}}{r} = \sqrt{k} = \sqrt{\frac{m\,v}{s}}$$

$$v = \frac{s}{t}$$

$$\frac{\mathcal{E}}{r} = \sqrt{k} = \frac{1}{t}\sqrt{m\,S}$$

$$\mathcal{E} = \frac{r}{t}\sqrt{m\,S}$$

Wenn fliess. Strom durch Draht

$$\mathcal{E} = \mathcal{J}\,t$$

$$\mathcal{J} = \frac{r}{t^2}\sqrt{m\,S}$$

nach Mag. Moment

$$i = \frac{\mu}{\pi R^2}$$

Magn. — Moment = Quantum X Abstand

$$i = \frac{\mu = \ell}{\pi R^2}\cdot\frac{r}{t^2}\sqrt{m\,S} \qquad \ell = \text{Länge}$$

$$\mathcal{E} = \frac{r}{t^2}\sqrt{m\,S}$$

$$i = \frac{\ell}{\pi\,\ell^2}\cdot\frac{\ell}{t^2}\sqrt{m\,S}$$

$$= \frac{\ell'}{t}\sqrt{m\,S}$$

$$\mathcal{J}_e = \frac{r}{t}\,i \qquad \text{Weber.}$$

Grösse in Geschwindigkeit.

Man kann mit Leitung fl.

Quantum kleine Potential gross

Langsamer Fläche durch Flüssigkeit langsamer zu entladen. Man nennt den Volt.

Weber und Kohlrausch

[illegible]

$$\mathcal{J}_e = c\,i_m$$

$$c = 311{,}130{,}000\ \frac{Mt}{Sec}$$

Weber $c\sqrt{2}$

Umgekehrt Winkel größer

$(2\cos\varepsilon$

—— für dynamische Verwandschaften

William Thomson

282.000 000

British Association

~~Max~~ Maxwell 288.000 000

Man kann im Handel bestellen

Stücke die Widerstände

300 000 000 : 1 zu messen

Chemische Methoden

Electrolitischen Maß ~~Weber~~ Weber

$\frac{1 \text{ Cub cent } OH_2}{1 \text{ Minute}}$, $0.9534 \frac{\sqrt{\text{mgr}}\ \text{Mm}}{\text{Sec}}$

$J = \frac{1 \sqrt{\text{mgr}}\ \text{mm}}{\text{Sec}}$ zersetzt in secunde

= 0.0092705 Bunsen

= 0.009239 Joule

Kirchhoffsches allgemeines Ohm

$iw = (S_1 - S_0)$

Quantität Wärme abhängig von Temp

S_1 → S_0

S_2

Berührung

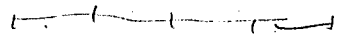
$i w_1 = (S_1 - S_0) - a_1$

$i w_2 = (S_2 - S_1) - a_2$

$i w_3 = (S_0 - S_2) - a_3$

$i\,(\cancel{w})\,\Sigma(w) = -\Sigma(a)$

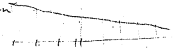
$i = \frac{\Sigma(a)}{\Sigma(w)}$



$$i\frac{w}{n} = S_1 - S_2 = \frac{S_1 - S_0}{n}$$

so man kann mit einem Grad u. Linie

zusammensetzen

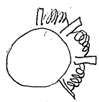


Riemann Meilen Telegraphendraht

1 Element durch 9 Meilen

2 .. .. 18 1

3 durch selben Strom 27



27

1 1/3 Ausschlag

18

1 1/2

$J = \frac{A}{W}$ $\quad A = WJ = WJ_1 + wJ_1$

$J_1 = \frac{A}{W_1 + w}$ $\quad W(J - J_1) = wJ_1$

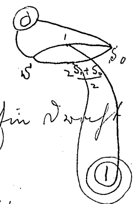
$$\frac{W}{w} = \frac{J_1}{J - J_1}$$

Geschwindigkeit. Elementen ändern sich auf einander

Nicht Strom da, wenn ein Strom ist oder nicht da ist.

$i_1 w_1 = S_1 - S_0$

$i_2 w_2 = S_1 - S_0$



Ein Draht besitzt $\frac{S_1 + S_0}{2}$

kein Strom

Differenz $\frac{S_1 - S_0}{2}$

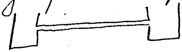
$$\frac{S_1 - S_2}{S_2 - S_0} = \frac{W_{12}}{W_{20}}$$

July 3 $J = \frac{\Sigma A}{\Sigma w}$

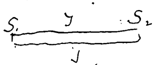
Etalon von Jacobi

Ohm Weber Siemens

Praktisch leicht zu finden. Nicht schwer

Widerstand 

1,1, 2 5 10 10 20 50 100 etc



$W = \frac{\text{Länge}}{\text{Querschnitt}} = \frac{L}{Q}$

$W = \frac{L}{KQ}$ K = Leitungsvermögen

Leitungsvermögen Elec und Wärme beinahe

Ag	100
Cu	77.43
Au	55.91
Al	33.76
Zn	27.39
Cd	23.10
Fe	14.44
Pt	10.53
Qu	1.63
Graphit	0.0693

Leitungsvermögen Cu
Sehr Fe
Dünner

NO_3H 29.7 $= 7330 \; 10^{-8}$ Hg

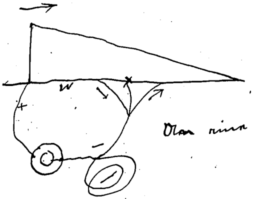
HCl 18.3% = 7174

H_2SO_4 30,4 = 6914

Etalon W

Kohlrausch ~~Kali~~ zusammengestellt aus die verschiedenen Leitungsvermögen ~~de~~

Vergleichung electromotorische Kräfte

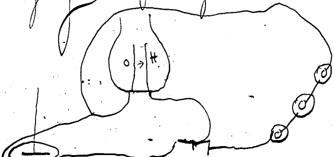


Oben eine Skala

$$Jw = S_1 S_0 = A$$

$$\frac{B}{W} w \qquad \frac{B}{A} = \frac{W}{w}$$

July 6 Polarization.

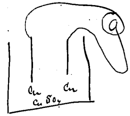


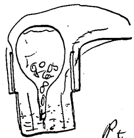
O → H

Polar

O ← H

Elec. Motor Kraft
kein Resultat erhalten 2.03, 1.7 D

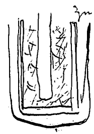




Grove 1.7 D. mit SO_4

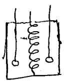
Bunsen mit C

Pt billiger # nicht so viel NH_4O_4

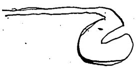


July 8
Palladium Pole 0  W

Versuchen
Leitungs Körper Wärme
Grosse für Flüssigkeit fähig.
Lenz
und Edlunds Me W-Eq Joule
Strom Intensität
Wärme Entwicklung J^2
Drähte verschiedene Metal
Wärme zu W
Calorimeter



Blei
Alcohol
Dünner Draht
Thermometer



Thermometer wenn kann Flamme hinein tauchen

$\Theta J = J^2 w$ $J = \frac{E}{W}$ $J = g^{425}$ Mt
$= J \frac{A}{W} w$ W die Kette
wenn Wärme von Gesammte
$w = W$
$\Theta_w J = J A t$ A = electromotor Kraft
t = Zeit

Chem. Verwandtschaft der Strom in selbe Richtung
Metal brennen in Cl.
Die — der Metal desto grosser Elec-K.

K
Hg Na
Z
Rb
Cu
Ag
~~Pt~~
NO_2

Grove Zn NO_2
austreibt
Zn — Cu 1.
Zn NO_2 1.7

Immer ~~das~~ die selbe Wärme Menge
von Brennen
H – O. Luftstürzen wenn zusammen
kommen Geschwindigkeit zum Wärme

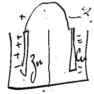
Von den Lorenz und Villari

$\Theta_w \, Jt = J A t$ = gleich W-M - durch chemischen Process.

$q \, Jt = Q$ = Quantum Zn das eintritt.

Electromotorische Kraft
Proportional zum W-M -
Zn K, Na, unabhängig von
Säure

1 gramm H / K	~~272.4~~
Na	27224
Zn	40524
Fe	43741
Pb	54430
~~H~~	57216
Cu	62591
Ag	79042
NO_2	81.00



$\underset{+}{Cu}$ W Bestandtheil,

$\leftarrow SO_4 \underset{+}{Zn} \rightarrow \leftarrow SO_4 \underset{+}{Cu} \rightarrow$

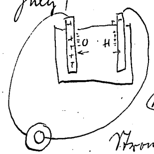
Electron am Atom.
Neutral für Neutral.
~~Z~~ — Atom mit $\mp$ Strom

+ Kathode
(Zn) - (Cu) ~~Aequivalent~~ Aequivalent

$(Zn) - (Cu) + (P_Z - P_{Cu})$

Wird unterstützt durch Potential.

July 9



nach Strom

+H am einen Pol

−O " "

Condensator mit einer

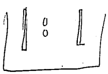
Molecülen gezeichnet

Strom entsprechend Ladung

Condensators

Opal. flammend vom ersten Starken

Strom Atmosphären ~~[illegible]~~ f. O



Kann H weg nehmen

Ein Metall ~~im~~ im innern

Palladium

1 Vol. Palladium 936 H nimmt.

Rein		mit H
12.38 Sp. G.		11.79

Das H muss 1.78 − 1.98 Sp G

H ein Metall. Wie zu Metall

condensirt.

Cu. Ag. ein schwarzes Pulver

Jaz Root Giesse.

 ?

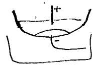
Wasserstoff geht durch Pt

Arbeit $(H)_{Pt} - (O)_{Pt} = P_- + P_+ \qquad P_- = -P_2$

$= P_1 - P_2$

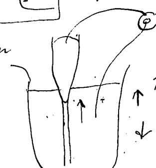
Arbeit von H_2O H O ~~trennen~~

Die Reibung fl. in Draht.



Hg nach kugel formig ∽∽

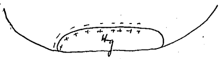
Rohren



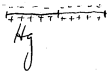
↑ Hg zurück gehen ∽∽

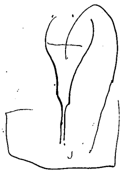
↓ " ↓ ∽∽

Umgekehrt ∽



Geladene Fläche





~~Gefundene~~ Geschwindigkeit an Hg ausfließen

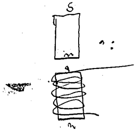
Lippmann Electrometer

Erhaltung der Kraft gilt aber so.

$J^2 w t = J A t$

$J^2 w$ = Arbeit

Strom kann arbeit in Maschine.



$-J dJ + J w t = J A t$

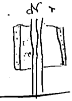
$J w = A + \frac{dJ}{t}$

July 10

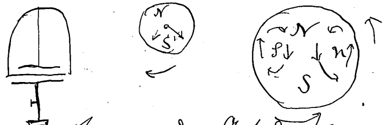
$\alpha J + (AJ = J^2 W) - J\frac{dP}{t}$

$\alpha J = -J\frac{dP}{t} \quad \alpha = \frac{dP}{t}$

Faraday



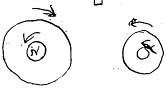
Erste Phänomen Arago



Immer der Art den Magnet in Ruhe zu bringen

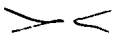
Spiral

Strom unterbrechung

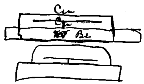


einfache ober

Licht



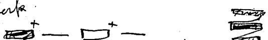
Thermo flex



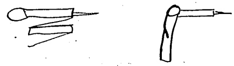
Bi Ni Pd Pt Cu Hg Pb Sn Fe Au

Ag Zn Cd Fe As Sb Te höher Temp

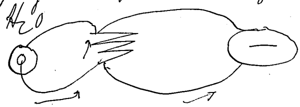
Peeraks



Sound heißer Kugel. Ziemlich
leicht zu erwärmen für Strahlen



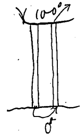
Polarisation der Paula Strom durch
July 15 Thermo Paula zersetzung von
H_2O



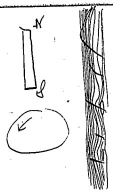
Wirkung der Paule entgegengesetzt

Sir William Thomson

Metall flex nimmt Wärme
mit,



Cu + flex mit führt Wärme
Sn − " " " Wärme

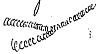


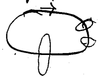
$\mathcal{H}$ $\mathcal{A}$ $\mathcal{A}$ $\mathcal{A}$ $\mathcal{A}$ $\mathcal{A}$ $\mathcal{H}$

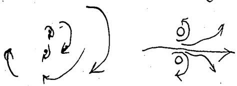
$AL = J^2 w + J\rho$ Wärme [illegible]

Nähe ein Strom Spannungs-
zustand Medium

Faraday



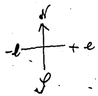




Äther Kraftlinien
sich zu verkürzen
strebt.

Maxwell

Äther Dielektricität
Licht Äther muß das füllen



311,130 Kilomt.

Kette Äther. Maxw. nach einander

als ob solche Kraft

Zöllner ~~und~~

Gravitation kein besser als Newton

Wilhelm Weber

e E

$\frac{eE}{r^2}$ nimmt an

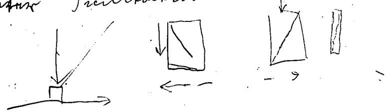
$\frac{eE}{r^2}\left(1 - \frac{1}{c^2}\left[\rho'^2 - 2r\rho''\right]\right)$

Kraft von Beschleunigung der
Geschwindigkeit

Licht

Olymp. Zeit braucht. Planeten-

Jupiter Occultation



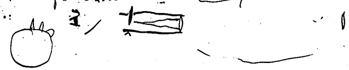
$\frac{2\pi R}{\text{Jahr}} = v$ Durch ganze Sonne Durchm.

Erde 41000 Meilen

Venus 39700 Sec

Jupiter 42219 313274.3 Kilo

298500



8633 Mt

Cornu

$\frac{1}{20000}$ Sec in Allen

Meilen

Rod 920 Zähne

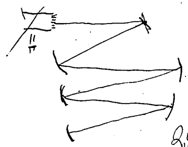
12,6 mal in Sec

9072 zwischen Zeit

18000

Weber 311130 km Elektricität

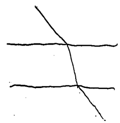
Maxwell 288000 " "



700 800 Umdrehung in Sec.

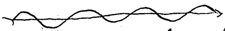
Dichteres Medium langsamer als.

Zu unterscheiden zwischen



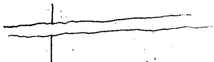
Licht übertragt in andern Form der Bewegung z.B. Wärme

Interferenz



Transversale Schwingung

Strahl

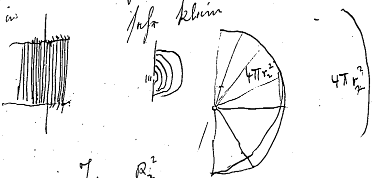


Schall hört man nicht in gerade Linien

Wenn Öffnung sehr breit gegen Wellen lange Fortpflanzung sehr stark.

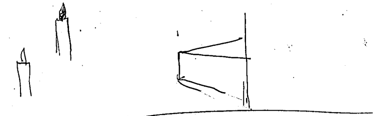
in

sehr klein



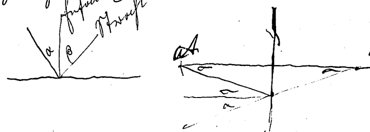
$$\frac{J_1}{J_2} = \frac{R_2^2}{R_1^2}$$

Messung Bouguer.

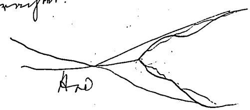


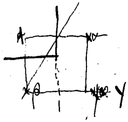
Spiegelung

einfallender Strahl



Alle Strahlen kommen von ~~A~~ A wie von A' betrachtet.



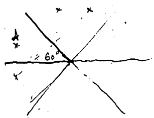


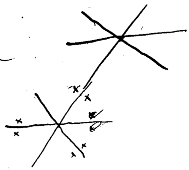
A Spiegelbild α

B β

B m γ

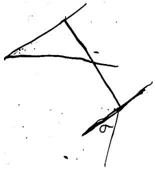
α m γ

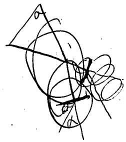


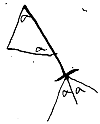


Prisma

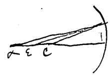
Heliostat



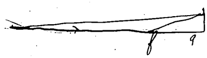




Sextant



Strahl am Spiegel.
sehr kleines Stück



$$\frac{x}{f} = \varepsilon$$

$$\frac{x}{g} = \eta = 2\omega - \varepsilon$$

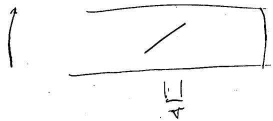
$$x = R\omega$$

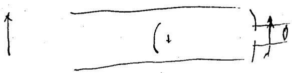
$$\frac{x}{g} = \frac{2x}{R} - \frac{x}{f}$$

$$\varepsilon - (-\eta) = \varepsilon + \eta = 2\omega$$

$$\frac{1}{f} + \frac{1}{g} = \frac{2}{R}.$$

Spiegel mit Lorinn Licht



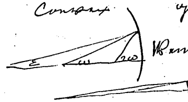


$$\frac{1}{f} + \frac{1}{g} = \frac{2}{R} = -\frac{1}{F}$$

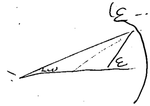
Differenz $\frac{1}{f} + \frac{1}{g} = \frac{1}{F}$ mache eine Lampe

Concav Brennpunkt vor dem Spiegel Convex hinter dem Spiegel

Convex vermindert Divergenz
Concav vergr.

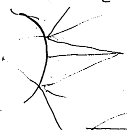


$(\varepsilon - 2\omega) = -$



$(\varepsilon - 2\omega)$ Bild hinter Spiegel

$\varepsilon - 2\omega = \pm 0$



$\varphi' = f - F$

$\varphi'' = g - F$

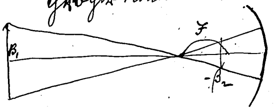
$gF + fF - gf = 0$

$\varphi'\varphi'' = fg - Ff - gF + F^2$

$\varphi'' = \frac{F^2}{\varphi'}$

$\varphi_1 = \frac{\infty}{0}$ $\varphi_{11} = \frac{F^2}{\varphi_1}$ einfach

Grösse der Bilder haben wir folgende Gesetz gegenseitiger abstand bezeichnet

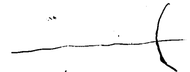


$$\frac{B_1}{-\beta_2} = \frac{\varphi_1 - F}{F - \varphi_{11}} = \frac{\varphi_1(\varphi_1 - F)}{F\varphi_1 - (\varphi_1\varphi_{11}) = F^2}$$

$$= \frac{\varphi_1(\varphi_1 - F)}{F(\varphi_1 - F)} = \frac{\varphi_1}{F} = \frac{F}{\varphi_1}$$

$$-\frac{\beta_1}{\beta_2} = \frac{F}{\varphi_{11}}$$

Grösse



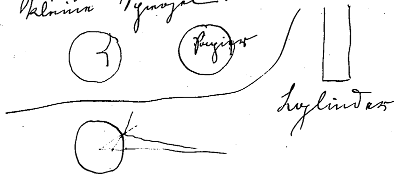
[illegible]
Bild hinter dem Spiegel.

Festgestellt $\varphi_1 \varphi_{11} = F_2$

$$-\frac{\beta_1}{\beta_{11}} = \frac{\varphi_1}{F_1} = \frac{F}{\varphi_{11}}$$

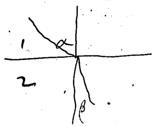
φ_{11} bezeichnet Entfernung Netzhaut.

Gesetze so weit annähernd. und für kleinen Spiegel.

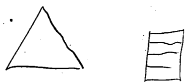


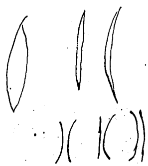
~~Der~~ Brechung

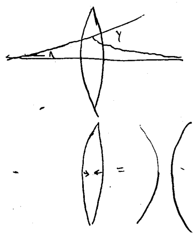
$$\frac{\sin\alpha}{\sin\beta} = n_2$$

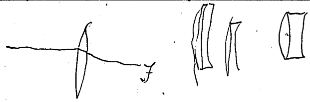


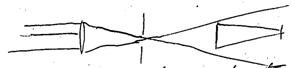
$$n_1 \sin\alpha = n_2 \sin\beta$$





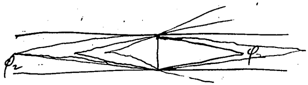




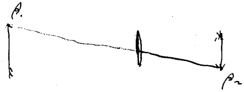


Could not understand what he said

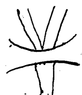
~~Keplersche~~ Fernrohr



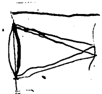
$$\varphi_1 \varphi_2 = F^2$$

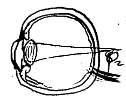


$$\frac{\beta_1}{\beta_2} = \frac{\varphi_1}{F} = \frac{F}{\varphi_2}$$



Brennpunkt — concave.





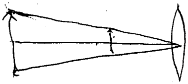
Man muß nach Gauß zwei Brenn
weiten $\varphi_1 \varphi_2 = F_1 F_2$

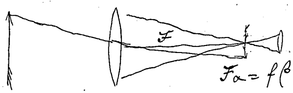
Man kann
Accommodation

kurz sichtig die Sehachse entfernt

Alt ~~R~~ verlorene Accomodation.

Langen





$F\alpha = f\beta \quad \frac{\beta}{\alpha} = \frac{F}{f}$

Man muß Auge wie vom entfernten Objekt stellen

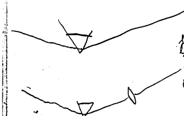
Objektiv muß wechseln mit

Man muß von viele Linse zu suchen

Immersions Objektiv

Bild sehr klein

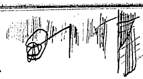
$\frac{1\ \text{mm}}{3635}$

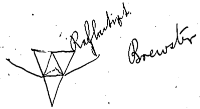


blau
grün
gelb
Roth Ende

Bild des Spaltes

5 Minuten





Achromatie

Roth $\Delta_r = \gamma(n-1) - \gamma_1(n_1-1)$

$\Delta_g = \gamma(\nu-1) - \gamma_1(\nu_1-1)$

$\Delta_r - \Delta_g = \gamma(n-\nu) - \gamma_1(n_1-\nu_1)$

muß $= 0$ $\qquad \frac{\gamma}{\gamma_1} = \frac{n_1-\nu_1}{n-\nu}$

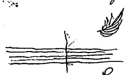
$\frac{n}{\nu} = \frac{n_1}{\nu_1}$

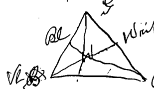
$\frac{n-\nu}{\nu} = \frac{n_1-\nu_1}{\nu_1} \qquad \frac{\nu_1}{\nu} = \frac{\gamma}{\gamma_1}$

Royal

Absorption

Farben Erscheinungen

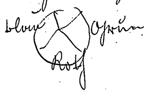




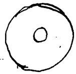
Farbentafel (Physiologisch)

für weiß

Scheiben zu Farbenfarben

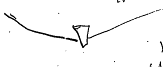


July 31 1878



Kirchhof

Ultra Violet



Wärme
ultra Roth

Photographien

Aug 1

Fluorescirt Netzhaut fluorescirt

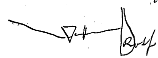
Wärme mehr zusammen Roth

Violet mehr zerstört

Lackmus roth

Licht ausgegossen über Spektrum. Je Wärme

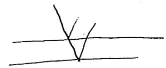
Absoluten Grenze

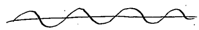


Roth

Interferenz

0 1 2 3 4 5 6 7 8





$\frac{\lambda}{2} + 2n\frac{\lambda}{4}$

$R(1-\cos\omega) = 2R\sin^2\frac{\omega}{2}$

$\frac{R\omega^2}{2} = \frac{\lambda}{2}(1+n)$

Na 50.000 Ringe

Francis R. Upton Notebook

This is the first of two notebooks used by Upton in November and December 1878 to conduct a literature search for the Edison Electric Light Company. Upton searched through patents and journal articles for information about arc and incandescent lamps. Many of the entries in the first part of the book pertain to patents for lamp regulators. On page 53 is a note by Upton about the uniqueness of Edison's lamp design. Near the end of the book are a few notes from patents and journal articles concerning the platinum group of metals. The first page bears the inscription "Mch 1905 This was my first work for Mr. Edison. FRU." The back cover is labeled "S" and "Heating substances." The book was used in both directions. The pages in the front of the book are numbered 1-75. The pages in the back of the book are numbered 1-15; there are also 5 unnumbered pages of notes.

Blank pages not filmed: 29, 34, 45-52, 61-64, 74-75 [front]; 12-14 [back].

Deborday

Allman p.p 7
~~Delmik~~ p 8

Sawyer p 35 36
~~Simmons~~

Francis R. Upton
115 East 14 St

$2.00 reward will be paid for return of this book if found.

Regulators 3

Saturday Nov. 16. 18[illegible]

Mch 1905
This was my first work for Mr. Edison.
Fran

1843 No 9745

Bain regulating current by lifting and depressing plates in the battery by means of clock work regulated by magnet acting on stop.

see p. 2

1845 King see Materials for carbon

1845 Wright 10.548 M. p. 2

1846 Greener & Staite " "

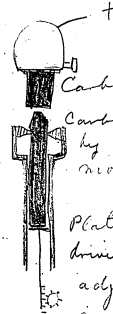
11.076 Page 5 M

1840 No 8644 Burying plates in the

Pinkus nothing ground and running trains mills &c with the electricity.

1846 No. 11.449

Staite's

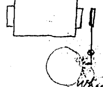


Carbon held in place by tube and free to move.

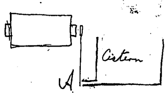
Plate on wh. C rests driven by clock work adjusted at a rate sufficient to keep its end burning!

1843 No 9745 England

Bain Alexander Nov. 27 1843



Wheel connected with clock work which lowers the plates in the liquid



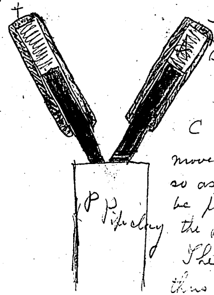
containing the fluid for the battery

A stop which is closed when the current is too strong.

A Clock work arrangement is suggested by wh. the plates shall be lowered at a regular rate

 J Curtis No 11,449

1846

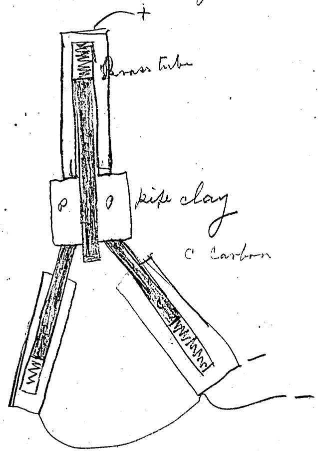


C carbon pencil moved by spring A so as always to be pressed against the pipe clay. The distance thus is kept constant.

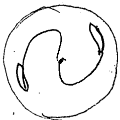
Fontaine p. 17

1846. Staite 11449

Modification of the above

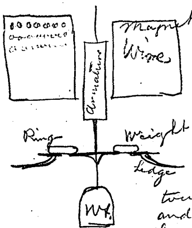


1847 Staite 11.783



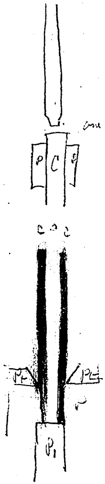
Centrifugal regulator
Wh thrown out and friction
stops speed

~~1847~~
Staite 11,783



wh. when the armature is in the neutral position just touches the ledge and is taken from the armature if it descends lower.

Staite 1846 11,449 4



Carbon held in pipeclay

C Carbon
P pipe clay
Pt Platinum

Burning against the Pt points the pencil presses into tube P_1

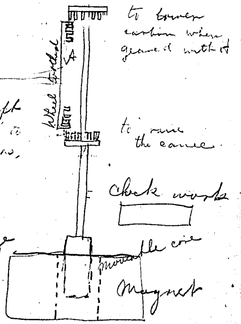
1847 11584

Bain regulating current by supply of liquid in battery preventing air from escaping and thus fluid entering battery.

1847 No 11783 Staite

Carbons

Screw playing into shaft which is arranged to lift the carbons,



see preceding page

Idea to telegraph by means of flashes through various colored glasses 5

The first

1847 July 3. to use clock works and magnets.

Staite No. 11,783. see History 1848 p. 61

Williams Edwards

To revolve and raise lower carbon by clock works. Centrifugal regulator for speed, with magnet

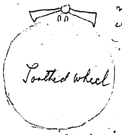
Patented France by Petrie. 13-271

~~1847~~

Staite 11783

Flashing light by withdrawing and advancing lower electrode by means of clock work.

Ratchet vibrating and made to play one way or other by strength of currents acting through magnet



The wheel is connected with apparatus for raising and lowering poles.

France William "Petrie" 13-271

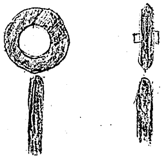
Taken out by Mm Gaigneau on Jan. 14, 1848. Refered to Comptes Rendus Vol 28. - 157

Staite ~~184~~ 1848

No. 12,212

A clock work vibrator which moves the lower carbon to suit the current. The regulation coming from a moveable iron core of a magnet.

Disk rotating for upper electrode



1848 12,??9
Le Molt

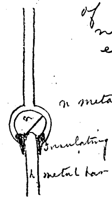
Two discs revolving

1848 Staite Iridium used Sp 1

1848 12.276

Allman p. 55

The change of contact of bar b with n heats n and thus whole rod expanding it. This expansion is utilized for changing Carbons.



Patented France 15-171

In Allman's French spec- he claims no general patent. only the two way shown.

see p. 55

1848 No 12276 7

M.M. Vol 50 300
35 305
Artizan 7 207
P.g 6 255

Allman L.J.

By the deflection of a permanent magnet by a conductor. N.G.

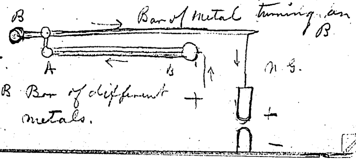
Repulsion of two magnets.

Decomposing effects. N.G.

~~Heating~~ effect used to govern distance between the poles.

No 1

2 Two bars side by side expanding unequally tend to separate the poles



A-B Bar of different metals.

1848 12.295
Hjorth Governor for magneto machine
1849 Deleuil French 16 - 4574 July 30
Juillet.

To regulate the ~~electric~~ distance between poles by magnet acting on lever lifting ~~one~~ of poles. Drawing so small could not trace exactly how. Read again Dec 2 and could not understand
Polytechnische Central Blatt 1855 p1131 an account with drawing telling mode of action.

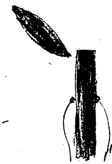
upper carbon held and moveable by hand

a catch acting into a detents so arranged as to lift lower carbon when current is too weak.

see R. p. 67

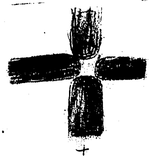
1849 No. 12.482

Pearce



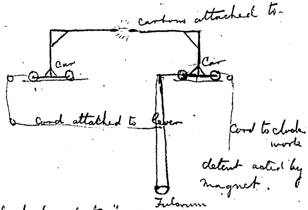
Disc and pencil each way ... by the same clock work

Platinum springs to hold Carbon with Iridium tips



Carbon serving to hold the other two from touching and giving a chance for the ~~...~~ arc

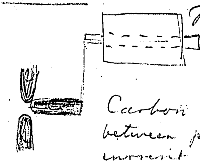
1849 Foucault · an account in Gavarret Traité d'Electricité Vol. 2 p. 511 1859
There said to be the best form then known



"The best to date"

1849 12.482 9

Pearce



Carbon placed between pts when current stops by a magnet

Regulating duration of light for Lt House.

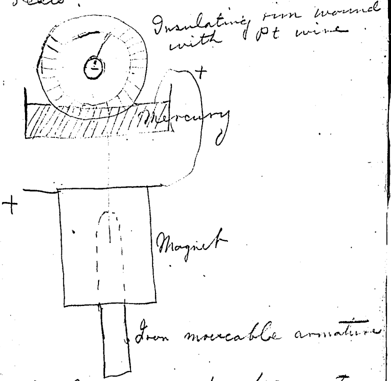
Repertory of Arts 14 193.
M M 51 189

See page 60 ~~4~~ to 65

1849 12,772

Staite and Petrie

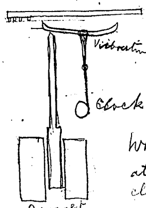
Increased current increases resis.



The movement of core turns wheel and brings more or less of Pt in circuit

1849 Staite & Petrie 12.772

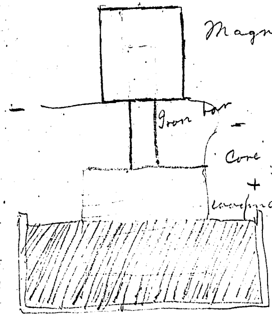
A counterpoise chain suggested which as carbon burns shall fall on support thus equalizing



When the poles are at their wished for point clock work locked by an arm from the core of the magnet.

1849 12.772 11

Staite & Petrie



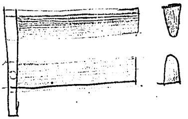
The change of current raises and depresses float bringing Pt wire in Circuit more or less.
Pt. wire contact can be used instead of Hg.

1849 12.899 Pulvermacher

Regulating currents by means of adding resistances. The — put in circuit through magnets. The drawings very blind.

Regulating by means of battery

Gillespie in Mech. Mag Vol. 50 p. 485 suggests exactly the form of the Wallace lamp and also that it could be made circular.



Staite and Petrie

An arrangement of spiral springs serving to prevent too great pressure of the Carbons.

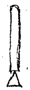
M. M.V. 52
pp 240 246 261

Artizan. 8 p. 65

1850 13.302

Shepard

In vacuo

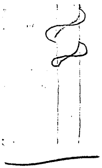


1852 13.933

Nothing

Pulvermacher

Allan's spiral electrode
Mech. Mag 47 p. 390

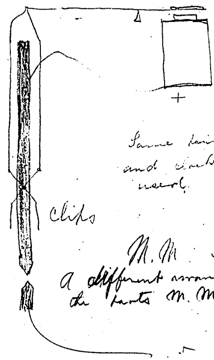


Two spirals placed at right angles to each other and made to revolve bringing fresh pts. for the arc to play between.
Like ?

1852 14.198 13

Robert.

An arrangement by wh. a magnet can act through mechanism to hold and raise the upper Carbon when current passes through it.



Same principle varied and clock work also used.

M.M 58 41, 56

A different arrangement of the parts M. M. 17 p 206 1857

1852 212
Could find nothing bearing on
extension regulating]

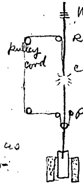
Dr. Watson's lamp Dingler Vol 130
p. 345 1853. Full account with
illustration. The lower carbon is
moved by spring playing into a
wheel from a second magnet.
Year Books of facts 1854
Mr. Watson claimed that the dye stuffs
manufactured in his battery paid
for the cost of running the lamp

1852. 14,330
Jackson clock work
sulphuric acid resistance
foolish

1852 212
Slater and Watson
Mechanism for adjusting upper carbon
by grip from a magnet.
Rheostats used for changing current France 1852 24-345

1852 No 561 signals for R. R.
1852 613 R. R. refused do.
~~1852~~ 595 Counter connection
1853 No 119
Binks Various fanciful contrivances without drawings.

1853. 700 Smelting metal by light.
1853 881 Gov. Goverson Elec. Mag. Mac.
Hayle



Upper carbon moving twice as fast as lower.

Germany

1854 Jasper of Lüttich mechanic

Polytechnisches Central ~~Blatt~~ 1854 p. 299

from Le Technologiste Jan 1854 p. 187.

In Poggen Vol. 139 – p. 495 1870

a lamp almost identical ~~to this~~

is described.

Staite. 1853 634

Carbon raised by float and regulated by friction clutch held by magnet (1088 pt)

1853 English 1806

Fontainemoreau

Complicated apparatus for regulating magnets and springs

1853 English 2457

Verdun Globes representing earth.

1854 English 83

Water Signalling

1854 English 2555

Varley "may be used for light".

1854 10888

Dering tapping iron in Hg.

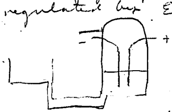
1855 England 739

Chapman Quite ingenious many variations on the same idea in this patent.

Upper carbon braked when current flows and lower carbon withdrawn giving arc. Current stopping allows the two to come together France 1855 48 - 120

1855 England 998

Escape of gas from decomposing H_2O regulated by Electro magnet.



When shut the gas forces H_2O out of receiver and thus over less surface [illegible] poles are located in it

1854 France 42-29

Lacassagne et Thiers.

1855 1646

Deschamps &

Lantern for work under H_2O

1855 2613

Puls

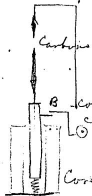
Escaping gases from battery

France 1855 50 - 22 - 13931

Upper electrode held in ways by magnet

Russia 1856 Bulletin d Societé d' Encouragement 1862 p. 270

System of Prof. Stakowski.
When current weaken lower pole is raised by spring H and on reaching a certain height releases detent B of clock works wh. lowers upper pole. Current strengthens lower pole falls clock works locked by detent holding upper pole.



connected with clock work

Core in magnet.

H spring see H. p. 71

1856 England 2456

Lacassagne Thiers

lower electrode floating in Hg supply of Hg regulated by magnet Fontaine p. 22

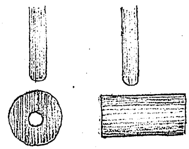
1856 2547

Way Mercury used falling Fontaine p. 32.

1857 573 Holmes Magneto for light

1857 England 588

Harrison France 1857 65 - 257



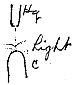
cylinders of C

Clock works for moving the cylinder and regulating distance.

1858 Duboscq and Marcais. The flow of oil regulated by a magnet.
— Dingler 148 – 194

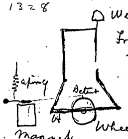
Harrison

Hg regulated with Magnet



Germany
1860 Stöhrer. Karsten's Encyklopedia Vol XX p. 1328

Weight conterbalancing frame work holding carbons free to move on lever A A'



When current weakens the magnet allows the detent to spring up and carbons are brought together by the weight.

1857 1033 18
Pascal. Br. Sp. Two currents regulating each other. The one through the lamps passing through a relay, wh. the current weakening opens auxiliary circuit. The 2 current decomposes water, the pressure from the gases brings carbons together
Dingler 156 - 278 1861
N. S. a 33.457.

1857. 1258 France 1857 61 - 326 62 - 310
Way Mercury apparatus Scient. Amer VIII p 279

1857 1412
Harrison various materials used for electrodes and 2 plants used to regulate carbons Poly. Journ 152-201

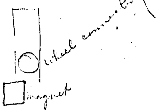
1857 2841
Way Hg apparatus Fontaine 32.
~~1857~~ Shepard 2987 Magnets.
1857 3164
~~Dan~~ Burleigh & 2
"Carbon coated with siliceous glaze"

1858 France Serrin 71. 174.
oscillating regulator Fontaine de
Guillemin very fine picture

1858 England Clark for Serrin.

1859 France 75-52

Grenet. The upper carbon counter-
balancing the lower. through a wheel
and the system regulated by a
movable core in magnet



1860 France 79-37 Lantin H p.76
System lower carbon overweighted being
attached by cord to upper. If current
is too weak the system is freed by a
detent lower and upper approach until
current flows then locked.
Bulletin de Society d Encouragement
1860

1858 Shepard 2368
carbon held by bridge pieces

1858 Hunt 282 Battery and carbons

1860. 1626 P. S Reflectors
1546 P. S Frictional sparks

1862 1516

Morris.
Vacuum tubes
Heating effects through Pt.
for jewelers
1863 Keeling Hanging cloth under light,

1864 1792 N. G
Eddy Extinguishing lamps

1867 261

Siemens
for lighting buoys &
Pt wire can be used.
He uses the static discharge of a
cable and magnet through vacuum tubes The magnet
breaking its own circuit.

1867 2221 P. S.
Electro Magnets for light

1861 France 81 Thiers Glass globes

1861 France 81 Prosser and Standly
gas burned

1861 France 81 Gramme
Wheel braked wh. connects with
carbon to electrodes, quite complicated.
worked only one way.

ball attached by
cords to poles

1863 France 86 Meynard.
to regulate pressure by Elec.

1863 France 86 Lontin et Digney
Wheel braked nearly the same princi-
pal as Gramme, One carbon moved
faster than other

1863-67 France 86 Foucault
Regulator Guillimin very
Fontaine &c fine picture application
page 676

Vol 81 missing

See Page 25

1/1867 Fr 2307
Holmes improvement in Mag. Elec.
Mac

1869 391 R.S. Magneto

1869 regulating gas jet in lamp

1870 1917 R. S. Dividing current so that one battery shall do 3 times as much work!

1872 3092 N.Y. Sheathing for ships

1873 no connections Thermo-pile new battery
3194-3540-3943-N.Y.

1874 265 Magneto Electric Machine

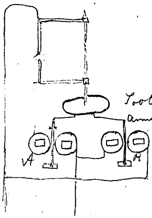
1874 2717 Compass cards

1874 3509 Fanciful. Batteries

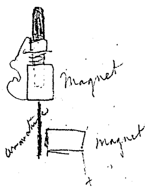
1873 618
Wilde
Carbon regulated by
means of right and left
hand screws. France 1873. N.S. 7.

*a fuel wh. may be used under boilers
&c

1873 France Siemens & Halske U.S. 7



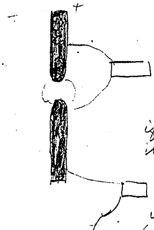
Toothed wheel
arms to move wheel
relays
A in circuit
R in shunt



1873 2006

Siemens

Two magnets used



with fine wire
Magnet in shunt btw two poles, connecte by ~~clock~~ work so that if poles are too far apart it will bring them nearer

Magnet in circuit large wire connected with ~~clock~~ work so that if the poles are too near and current too strong it will separate them.

1874 1261 U.S. Feb. 1874 p. 774
under Day.

Lake ingenious contrivance to keep the carbons near each other by means of magnets.
The contact is made and [illegible] carbon withdrawn by core magnet.

1874 Improvement Oct. 20 ~~187~~4

1874 n 1446

Johnson. Nothing practical.
electrophorus &c.

1874 1820 Whitehouse
Rods of C 90° revolving
no drawing

1874 4435
Powell arrangement for putting
C in air tight globe

1875 2767 P. S Kostoff
heating C
3466 Mercury jet and
battery

1876 3315
Johnson
arrangement for moving both
carbons and extinguishing
and lighting.

1876 Sept 11 No. 3552

Paul Jablochkoff Paris

To light a small strip of C is placed between poles.

"Void by reason of the patentee having neglected to file a specification in pursuance of conditions of the letters patent"

1876 Nov U.S. Gt. 184.553

1876 4312 Clark monthly

Placing light on a buoy

1876 Weidermann 4805

See page 30

1876 Varley 4905

Electro Magnet Machine ~~for high~~ potential.

1877 Eng 494
Jablochkoff
complete patent for candle

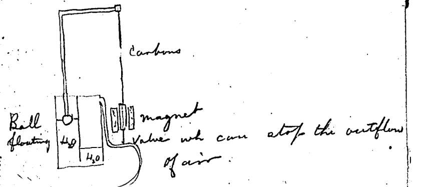
1877 Eng. 1996 Jablochkoff.
Heating rod of kaoline by means of secondary current.
~~of~~ See heating solid conductors

see page 31

1866 ~~France~~
Regulateur Gaiffe Médaille d'argent
Bulletin de la Société d'Encouragement
~~Feb~~ 1866

1867 Feb. – B. de S. d'E –
Medaille d'or for improvements

Mr. Highley proposed and made a regulator by wh. the carbons were regulated by the escape of air from a reservoir. The valve opened and shut by magnet — called the Maldens Pneumatic Regulator Pop. Science Review 4-138



1871

1871. France Chutaux Nouvelle serie.
Tome 1 No drawing:
Pulley worked by magnet

1872

France Chuteaux Nouvelle Serie. 4
No drawing, Magnet acting on ratchet

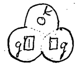
1872 Lodyguine N.S 4
Heating bodies to redness!

1872 U.S.A. 123,923 Jan
feed motion with clock work -
"retrograde lever or motion".

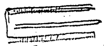
Day USA.?

1874 France 11
Lambrecht and Witten
Battery

1874 England Apr. 24. 1438
Werdemann Werdermann
Using the Electric arc with
a blow pipe for mining. The
arc can also be pointed against
the rock by means of a mag-
net. The rock is thus disinte-
grated. The carbons were brought
into the field parallel to eachother.
how they were separated not mentioned.



k pipe for air
g g carbons

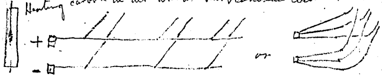


Carbons
Magnet

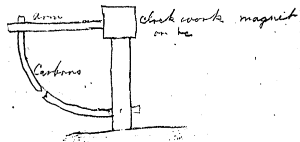
1876 see pages 22-23

Comptes Rendus t 82 p 280
Electric light regulator. Main current works relay which by auxiliary currents works apparatus for raising or lowering the carbons
Dingler 220 - 281

1876 Aug 29 Woodward. 181.613 1876
Illustrates but does not claim as new mode of dividing currents
Heating carbon in air wh. will not combine with it



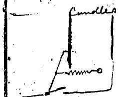
England Dec. 12 No. 4805 1876
Werdermann. Carbons in a curved form



Carbons placed side by side and insulated with mica or placed in cylinders  hollow or not insulated He also uses a coating of boracic acid to protect the carbons from the air. He claims a coating of metallic oxides

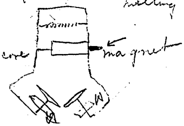
1877 ~~Danaygrouse~~ English 1877 - 3170.

Kindler for the electric light used with Jablochkoff candle.
A spring pressing against the candles, wh. when burnt to the spring allow connection to be made to the next candle.



1877 Reynier U.S.A. May 191.177

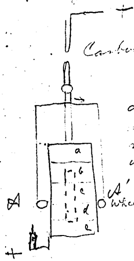
carbon made of disk, carbon, sugar iron filings. Iron core pulled in pulling disks apart



W Clock work

English 1877 . 2934.

Clark Reynier arrangement by which the core of a magnet is always in field



abcde coils with connections arranged so that the current will flow through only part say d c b

A' wheels giving contact

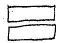
1877 Clark for Reynier 2952

Disks for Electrodes in various positions. Carbon Sugar Fe filings.

1877 English 1910 May
Heinke P.S. Two discs

1877 English 2944
Clark for Lontin see p 05

1877 U.S.A 198,436 Dec
Wallace
Two edges of carbon brought
near each other



see
Greener & Staite

1877 Sawyer 194500

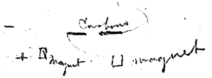
Claims 1 The method of obtaining an electric light, consisting in heating a refractory substance by bringing it into contact with a heated conductor of electricity.

2. An electric candle in which a ~~con tact~~ conductor of electricity, heated to any desired degree of intensity, renders luminous a non conducting substance in contact therewith, as set forth.

3. An electric candle, in which the circuit producing the light is en-

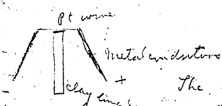
---

Siemens has p. 21



1877 Sawyer 194500 Aug

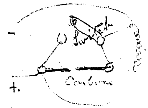
Improvement in Electric Candles &c



The metal is heated in contact with the clay and thus heat clay.

Sawyer 194,111 Aug

Method of using current with lamps



Resistance fixed or variable for regulating with. I think this may be new.

1877 aug 21 No 194500 Sawyer

tinely metallic, in combination with a substance which is rendered luminous by heating."

4 An electric candle, in which the light is produced by the direct action of the electric current upon its conductor, in combination with clay, lime, or other refractory substance substantially as shown and described.

5. An electric candle, the combination, with a refractory substance rendered luminous by heat, of apparatus for forcing the same to a constant heating against a heated conductor, substantially as shown and described

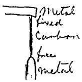
---

1878 205,144 June

Sawyer Ismanni

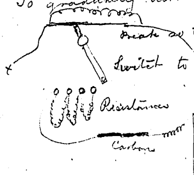
A globe which is filled with N. every part of which is patented because it belongs to the electric lamps.

If the rod breaks the carbon will be "gently forced to new connection"



1878 U.S.A. 205,303 June 25 37

To gradually turn the current on carbon

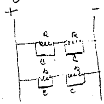


so that when switch is turned wire is broken ..

prevent to sudden turning on of the current.

Retarding device for switch as fan or compressing air.

Arrangement

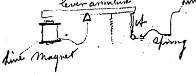


R - Resistance
C carbon

See Woodman p. 30

1878 Sawyer 205,303 June.

a safety switch is placed in circuit, and a fusible wire is suggested.



line A is freed when the current is too strong

"Change the circuit" = add or take away resistances, add or take away electromotive force.

Staite and Petrie 1849 p.10
&c

1878 38

Sawyer U.S.A. 205,303 June

He claims "In an electric lighting system, an electrical apparatus energised by the current flowing in such system, which, when there is an abnormal flow of current in a part or parts of such system, automatically operates to disrupt, disconnect or change the circuit of such part or parts."

This would cover nearly all regulators known especially

Staite and Petrie 1849 p.10
1852 p 14
Jackson 1855 p 16
Lacassagne et Thiers 1854 p 15
Dearing
Any regulator for adjusting carbons

"Energised by the current" = in any way affected by the current, magnetical electrolytical, heating or lighting effect utilized.

"Abnormal flow" = Any amount of electricity wh. does not fulfill this condition. With the smallest quantity of Electricity to produce the greatest light.

1877 aug 21 [illegible]

1878 Sawyer U.S.d 205,305 June 59

An ingenious arrangement to regulate the steam to the driving engine of magneto. Complicated

1877 English 2585
Prosser and Moore
Patent dated Jan 5 1878

1 Use of strip of carbon
see Greener & Staite 1 Page 5
1874 Eng. 1820 Whitehouse

2 Use of carbons in circular frame work
see 1845 Wright 10,548 1. P.2
1848 Staite 12212 P.6
1848 Le Molt 12,219 " 6
1849 Pearce 12482 " 8

3 Application of flowing electrode of Hg. Two or more.

4 Moulded electrodes
see 1847 Staite 11.783 1. P.9

5 Short detached pieces of carbon

1878 English 2585 Prosser & Moore
6 all in various ways construed
7 Discs

1878 July U.S.A. 205,962
Jenkins. Carbons in segments ~~of~~ tips. Arc playing against refractory substance

---

Rapieff; description in the Daily Graphic Dec. 10 with illustration said to be used in the London Times office. Could not understand the drawing

Aug Hugo Sep 3 207.753

1878

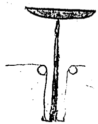
Tube for furnishing air to
or gas to arc

207,754

Lamps for furnishing carbon
to the pts by combustion

Werdermann regulator 1878 4/4

— description in "The Nature" and Scientific American



The carbons touch and thus allows a smaller amt. of current to be used

From 1766 – 1856.
The name of Slaum not
in the indices of Electrical
Patents for England.

I have looked through the
Indices and found no
patent but those which
I have read and notes
of which I have taken.

As far as I am acquaint-
ed with physical appara-
tus I never saw any
appliance in the least like
Mr. Edisons, though one
has often been wished
for, to produce a constant
temperature with the galva-

zic current

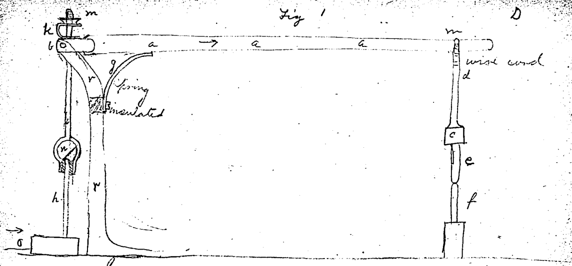
I noticed this in the digest of decisions for 1877

"An applicant who devised an experimental model, which was afterwards lost without test as to its practicability, and did nothing further until his contestant had secured a patent, cannot be said to be the prior meritorious inventor".

Stover vs. Clark 188

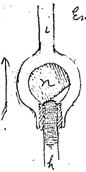
D

Fig 1



"Sheet D fig. 1 represents a side view of another arrangement of apparatus for the production of light from electricity. a.a.a, is a lever having one end turning freely on a fixed centre b, and the other end attached to the upper electrode holder i.e. by a piece of wire d. The wire cord is d. This cord d is soldered both to the lever a and the electrode holder c. Any upward motion, therefore of the lever a on the pivot or centre b would lift the electrode e from the lower electrode f; but the spring g constantly presses the lever a in this direction, and would constantly if not controlled, separate the electrodes. This, however, is prevented by the compound rod or bar h, i, which is fixed to the plate l. The upper end of the bar or rod i, being screwed, receives a milled nut m, which is screwed is screwed down onto the spring k until it so acts against the spring g as to keep the electrodes e and f together

1848 Allmann 12.276



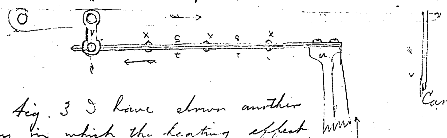
Enlarged drawing

The compound rod or bar h; i has a cock n into which the lower piece h is fitted by a nonconducting bushing as shown colored red. I would here observe that all the parts colored red ~~are~~ are made of non conducting substances. Now the current of E-B, upon entering by Cu ribbon o, passes up the bar h through plug n of the cock, through i &c. back to battery.

The plug of the cock n (which is on one part filed flat) being in the position shown in the drawing, that is, so placed that the flat part is in some measure presented to the conductor h, it does not afford a sufficiently conducting sur-

face of contact between the plug and the bar h. The result is, that as this surface contact is diminished by turning the cock, the cock and bar h, and i become heated by the passage of the current, and and this heating effect can, by setting the plug n of the cock, be made to suit the quantity or nature of the current employed so that a given current shall be made to produce a given heating effect, or heat the rod h, i as much as necessary. But the same current passes also from one electrode to the other as before described and when the rod, h, i becomes heated it expands and by its elongation allows the spring g to separate the electrodes e and f. by lifting lever a a described When the current is cut off h, i cools and the electrodes return by its contraction into contact

Fig 3 with 2



Carbons

"In Fig. 3 I have shown another way in which the heating effect of the current may be made to govern the position of the electrodes e and f. This is effected by means of a compound bar s.t the electric current being sent through the bracket u into the bar s,t across the link v, wh. couples it to the lever a, and thence as before through the electrodes to the battery, the bar s,t being made of such a size that the current will by passing through it heat it sufficiently to cause it to curve or bend upwards, t being the being the convex and s the concave side of the curve, owing to the unequal expansion under similar temp. of the brass bar t and the steel s which are riveted together by the rivets x x x. This curving of the bar it is evident will, by lifting the lever a by means of the link v separate the electrodes as in either of these arrangements the current by thus separating the electrodes ~~tends to destroy~~ itself it will be evident that by turning the coat n, or proportioning the size of the bar s,t the cause and effect as to heating and separation will mutually govern each other.

Allman 1848 12,276 58

"In this sheet I have shown how the calorific effect of E- may be employed in an apparatus for the production of light from E. The same effect may be produced by a variety of other similar arrangements, in wh. the calorific or heating effects of the current may be rendered available for separating the electrodes, and maintaining them at a proper distance from each other And I claim as my Invention and the exclusive use of an apparatus whereby the heating effects of E- may be employed and rendered available in and for the production of light from E-.

Nothing more bearing even remotely on the question.

1848 Allman 12,276

Mechanics Journal says after description summary. 50–306

" The patentee describes next a
"modification of the foregoing ar-
"rangements, and refers to some
"illustrative figures upon a sheet
"of drawings which he has omitted
"~~to~~ enrol, and in the absence of wh.
"this part of his very intelligible
"specification becomes "confusion
"worse confounded!"

London Journal says: 35–307

"The patentee remarks that by various
"other analogous arrangements, the
"calorific effect of a current may
"be rendered available for separating
"the electrodes and maintaining
"them at a proper distance from
"each other.

"He claims the use of appara-
"tus whereby the heating effects
"of E- may be employed and

1848 Allman 12.276 Eng. 60
V, "rendered available for the production
"of light from E."

1877 Eng. No. 2094 Nov. 28. 65.

~~C~~ A. M. Clark of 53 Chancery Lane

for Lontin and Co Paris France

This invention relates to improved means of controlling the mechanism for regulating or maintaining at a uniform distance apart the carbon points of an electric light. Such regulators may be roughly classed as being so constructed that the carbon points are moved towards one another either automatically or by clockwork. A special apparatus operated by the current is sometimes applied either to arrest the mechanism by which the carbons are fed up, or to part or distance the carbons, and to effect this stoppage or separation, as the case may be, electro -

magnets are often employed, 66
which, on the passage of the
currents operate to produce this
result.

This invention consists, first,
in the employment (in lieu of electro-
magnets) of a simple wire (or
its equivalent) which by the
passage of the current becomes
heated and consequently expanded
or extended in length, this
alteration in the length of the
wire, or its equivalent, being
applied to control the action
of the various kinds of mecha-
nism used for regulating the
electric light. The wire
should be of such a
guage that by the passage
of the current it may be

heated to, say, 400° cent as a 67
maximum. If by heating a proper length of wire a sufficient degree of extension is attained, it will be readily understood how, by connecting the wire to a lever or other organ capable of being oscillated by the tension of an opposing spring, the extension of the wire may be made either to cause the arrest of the mechanism by which the carbons are fed together, or to part or distance the carbons according to the kind of regulator employed.

It will be obvious that a strip of metal of any form may be substituted for the wire, provided it will obtain

a sufficiently high temp- 68
erature and a necessary degree
of expansion.

In order to understand how
the extension of a wire is capable
of producing the necessary move-
ments for controlling the regula-
ting mechanism of the carbons,
suppose a silver wire 20 centime-
tres in length be used. Under
the action of a current ~~from~~ a
source of E— of sufficient power
the wire becomes heated to a
temperature of say 400° Cent,
and is lengthened to the extent
of say two millimetres. This
wire if placed in an electric
light regulator would be
quite adequate to produce
the movements necessary

for the proper working of 09
the regulator, especially as
in proportion as the luminous
arc lengthens the intensity of the
current passing through the
battery decreases. Therefore
when the arc has increased
in length the wire may be
150° or 200° only which would
cause a contraction of 10 to
14/10ths of a millimetre. Such
a variation in the length of
the wire is sufficient to en-
sure the proper working of
of all electric light regulators
whatever may be their ar-
rangement, it being under-
stood that the wire should
be of such a length as
will ensure the necessary

No 1 R = 1
2 R = $\frac{1}{2}$
3 R = $\frac{1}{3}$
in case of mul
4 R =
5
6

Do not understand

amount of motion.
~~The~~ invention thus consists
1st in the use of a wire
which is heated and dilated
or varied in length by ~~the~~
passage of the current for
the purpose of regulating
electric light apparatus
generally.

Fig. 1

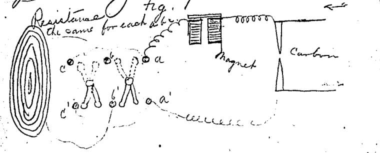
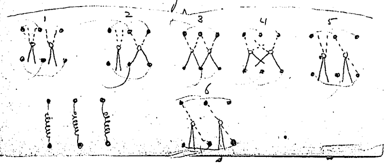


Fig 2



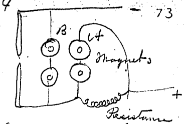
Claims

1st The use of a wire, a strip of metal or its equivalent traversed by the current and dilated or contracted according to the greater of less intensity of the current, the variations in its length thereby produced being applied to effect directly or indi- the separation or approximation of the carbons substantially as specified

2nd The use of a metallic wire ~~of~~ or strip for parting the carbons in combination with a resistance solenoid or electro-magnet excited by the

6 The interposition in a derivation of the current of a strip, wire or other uni-met. or multi-met. organ, wh. by its dilatn. — or extension under the influence of the current brings into action a commutator that electrically isolate, the regulator from the rest under the circumstances referred to

9 The interposition in a derivation of the current of a strip, wire or other uni-metallic or multi-metallic organ, which by its dilatation or extension under the influence of the current brings into action a commutator that electrically isolates the regulator from the rest under the circumstances set forth in the preceding.

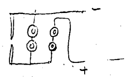


Substantially the same as Siemens p. 21 1873 France & England

A acts when poles are too near to draw them together

B when too far apart to draw them nearer –

Or



A commutator may be placed in the current.

I was compelled to read this four times carefully before understanding partially as I do now.

C. Chenet
320 Washington St
Hoboken
N.J.

Platinum

Heating solid substances

fu
21

2585
2934
2982

Last date English
April 20 1878
France Dec 28 1874
U.S.A July 31 1878

Mech. Mag finished
from June 1878
Scien Amer 1860 – 1874
Popular Science Monthly 1877–78
Review 1876
Wiedemann
Poggendorf
Annalles de Chemie & Physik
Philosophical Journal
Franklin Journal
Year book of Facts
Fortschritte G. 1856
" 1858
Dingler
Comptes Rendus
Central Blatt
Patents English
French
athenaeum

(N-78-11-19)

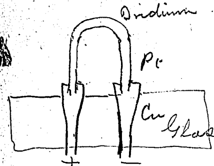
1845 10.919
King see page 4 Materials for Carbons
1846 Greener & Staite P. 5 " "
11.076
1841 De Molyns
see page 1 incandescense

1

1848

Staite

Iridium used and also mixture of Iridium and Pt.

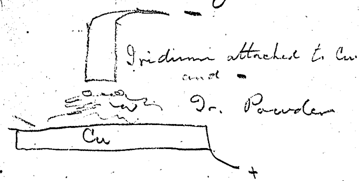


He sometimes places the wire in Glass to prevent radiation of the heat.

1845 King see Page 4 Materials.

1849 12.772
Staite & Petrie   see page 4 materials

Iridium, fusing.



A plate is formed by changing pt of discharge.

1852 595 Watson and Slater
Heating by means of fine Pt. wires

1852 14,198

Robert

Heating Graphite in vacuo.

Thin ~~[illegible]~~ strip used

1the same

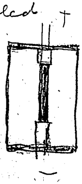
Places a candle but Electrodes increase Light. Lime the same

Uses lime with the carbon

1872 3809

Konn

Carbon in N. Hermetically sealed



Conducting power — Ency Brit 4

Cu. 1615

1652

Pt. 9158

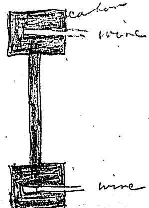
To seek substance infusible and of greater resistance.

1875 No 441

Kosloff St. Petersburg

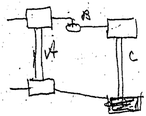
connecting carbon with non conducting substance.

Placing wire in larger piece of carbon to prevent sparks. U. S. A Aug 17 1875



1875 441
Koslofft

Automatic arrangement so that if one carbon breaks the connection is made to another



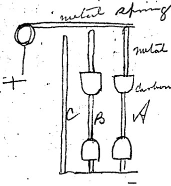
if rod A breaks the hook B makes connection with C

~~Hea~~ Carbon heated in vacuo or N. O. of air burnt out

An arrangement of valves

1875 Sept No 970

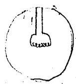
Jensen for Konn of St Petersburg



If bar A breaks connection is made with B.
If B breaks connection is made with metal rod C.

1875 2410

Chauvin & Paris



Pt. spiral in globe to be used under H_2O.

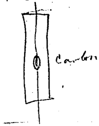
The text was missing for this.

Lake

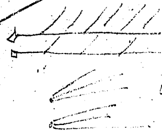
A small battery and connected with spiral wh. may be used for many purposes. The apparatus portable can be carried in pocket

1876 aug U.S. A 181,613 8

"Woodward" heating carbon in gas wh. will not combine chemically with it.



Filed Jan 4 1875



used method for connecting carbons

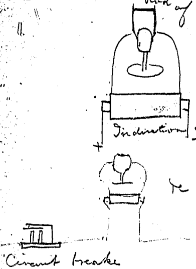
1877 U.S.A. 194.500 Aug 21 9

Sawyer's improvement in Electric candles. A non conductor around heated metal conductor.

1878 Sawyer USA 205.144 June p 36 A

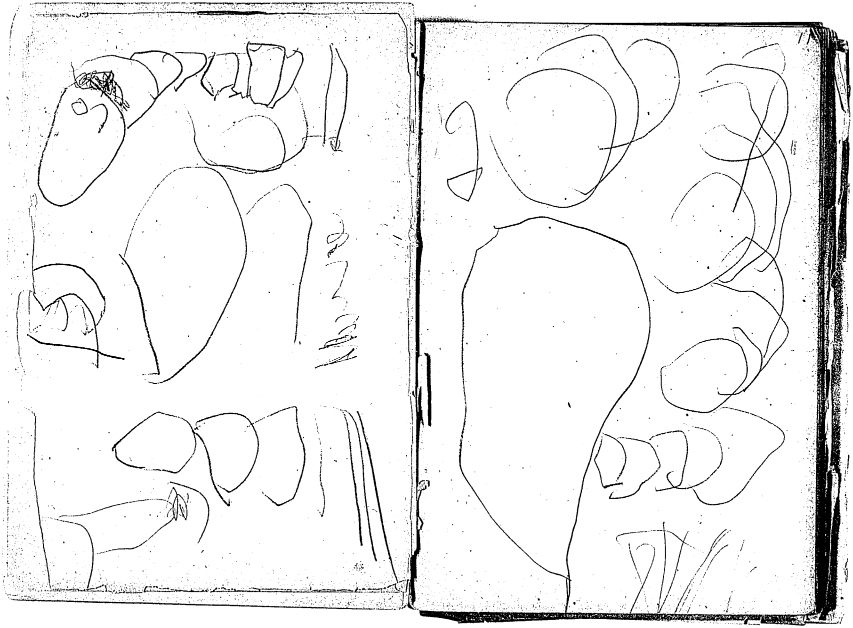
1877 Eng 1996 Jablochkoff

Heating volta nonconductor so that it becomes a conductor for secondary currents



A conductor is first laid on it to carry current and in heating to warm the Ka

Ie two or three on circuit



Cost of Electric light by Moses G. Farmer of Salem from Scientific American for June 8 1867, XVI-361

The experiments of Mr. Julius Thomsen of Copenhagen have shown that the power required to sustain the burning of one candle is equal to 130 foot pounds. Experiments by Müller Ritchie & myself using an E-light of not less than 800 or 1000 candles, power required per candle = 15 foot pounds. By measuring the heating powers of wire in H_2O a Grove battery pint cup size gave 80 foot-pounds per minute.

1° Fahr = 772 foot lbs.

1000 Groves gave 5000 candles

Cost	Sulphuric Acid	2½	per pound
	Nitric HNO_3	10	" "
	Zn	8	" "
	Hg	50	" "

Total cost about $27.65 per hour

about ~~—~~ 5½ mills per hour per candle

The cost of gas light

$3.25 per 1000 feet

1 cu. ft. gives the light of 3 candles

Cost of gas light per hour about

1 mill per ~~cp~~ candle.

With the Smee battery cost nearly the same as gas.

Cost with Magneto Machine

On a well built machine in 1861 1,100 ft. lbs. required per minute to keep the machine running. But when the circuit was closed 3,200 ft. lbs were required to maintain the same velocity of rotation; nearly all this excess (namely 2.100 ft lbs) of power was measured as electricity about $\frac{2}{3}$ (say 1.300 ft. lbs) being expended internally heating the coils magnets &c. and the balance 800 ft. lbs measured as external useful effect.

Suppose 800 ~~ft. #~~ ft-lbs. useful

$\frac{800}{15} = 53.33$ candles ~~p~~ which could be supported

---

Taking the total power

$\frac{3200}{53.33} = 60$ ft. lbs required to be given the machine per minute

---

In the vicinity of Boston power is furnished, at a rate of $180 per year of 313 day

$\frac{\$180}{313 \times 10} = \$0.0575$ per hour $5\frac{3}{4}$ cts

If one fourth of power utilized

$\frac{33,000}{4 \times 15} = 550$ candles from one horse power engine

Cost $\$ \frac{0.0575}{550} = \$0.0001046$

about $\frac{1}{10}$ of a mill per hour $=$ $\frac{1}{10}$ of cost of gas

Average hourly consumption of coal by a good steam engine may be set down as four pounds per hour per horse power

$= (33.000 \times 60) \div 4 = 495,000$

foot pounds from one pound of coal. Utilizing as electricity, and thence light, one fourth part of this

$$\frac{495,000}{4} = 123,750 \text{ ft lbs}$$

or as light

$$\frac{123.750}{15 \times 60} = 137.5 \text{ candles}$$

burning for an hour from one lb. of coal, through the agency of the steam engine and the magneto machine.

With thermo electric battery I have been able to develop 130.000 foot lbs. from one lb of coal

$$\frac{130,000}{15 \times 60} = 144.4 \text{ candles}$$

Gas

3 hour candle lights per cubic foot

15 hour candle lights per pound of coal used

~~[illegible] = 5~~

About 25 cubic feet of gas weigh one ~~[illegible]~~ pound. Hence one lb. of gas will yield light equal to that from one candle for 75 hours.

Theoretically
One pound of pure carbon ~~coverted~~ wholly burned gives 14.500 units of heat or

$$772 \times 14.500 = 11.200.000$$

foot pounds
In candles

$$\frac{11.200.000}{15 \times 365 \times 24 \times 60} = 1\frac{5}{12}$$

or a candle burning for one year and five months

Recapitulation
Gas from one pound of coal give one candle for 15 hours
One pound of Gas gives one cande 75 hours
Could all the energy in a pound of coal be converted in light it would give the equivalent of one candle for 12.410
Thus considerably less than the 1 p.c. is obtained in light.

Francis R. Upton Notebook

This is the second of two notebooks used by Upton in November and December 1878 to conduct a literature search for the Edison Electric Light Company. Upton searched through patents and journal articles for information about arc and incandescent lamps. The pages at the beginning of the book contain a chronological account of attempts to devise electric lights. Near the end of the book are a few notes from patents and journal articles concerning carbon lamps. The front cover is labeled "H," and the first page is inscribed "History." The back cover is labeled "M," and the last page is inscribed "Materials for Carbons Outline for History." The book was used in both directions. The pages in the front of the book are numbered 1-92; there are also 13 unnumbered pages. The pages in the back of the book are numbered 1-20.

Blank pages not filmed: 25-28, 32-33, 35-38, 44, 46, 50, 56, 83, 88 [front]; 12, 18-20 [back].

Draper p. 60
Grove p. 18
Mechanical Equiv. p. 11
Dumas 47

Cabinet 109
Shelf 1

34 W 15 St

15000
500

30 9
900

History

C Goddard
Secty

3 Broad St.
Room 44

Arc of four inches in air in vacuum of seven.

1802 Curtet observed the light which could be obtained from carbon pts. Berlin Fortschritte 185 713
Vol VI

according to Quetelet Curtet observed the light bet. carbon pts. in 1802.
Wied. Galv. Bd. 1 783 Ency Brit

For account of heating wire De la Rive Vol II p. 205

Sir Humphrey Davy, about the year 1813 discovered "the voltaic arc". Battery of 2000 prs. each surface 32 sq. in. Zn. & Cu. Acidulated water. Eng Abridge. Vol I pp. LX

---

see Davys Elements of Chemical Phil. pp. 152–~~153~~ 154. 1821

De la Rive Treatise on Elec ~~tric~~
Vol II pp. 282–283

Ency. Met. Galvanism
Vol IV pp 176, 178, 222

1819
Hares Calorimotor

Ency. Met Vol IV pp 222
Gmelin Handb. Chem
Vol. 1. pp. 409, 410

1820
Sir Humphry Davy
rotation of arc of Electric
light by magnet.
E. Mat. Vol IV. pp 9.10.

1821
Hare's deflagrator

1836. Daniells
Fused Titanium with 70 cells
heated 11 feet 4 in No 20 Pt wire.

Ency Brit. 7 Ed.
Voltaic Elect. pp. 669-671
√ Gmelin Handbook Chem
Vol. 1., pp. 393. 421
Bakewell's Electric Science
pp. 43. 166.107.

1837 Dr Andrews
Phil Mag June 1837
Vol. X, p. 433.

1845 M. Heider employed
pt. wire to cauterize.
De la Rive. Vol. III p 687

1848 M. Foucault
De la Rive Vol II pp. 326.328.
Vol III pp. 310-315.

1855. Dr. Middeldorpff. Breslau
~~1855~~ published on Galvanic
cautery
De la Rive Vol III 687-690

1858 Matthiessen
coke ~~carbon~~ better conductor when hot

1882 Sheston Electric Light
Phil Trans. 1882 599
" " 939

In Van Nostrand — Authorities

De la Rive $36.50
Du Moncel $22.40
Noad $12.
Roux $2.00
Lumiere Electrique applique à la navigation .50
Becquerel $36.25
Fontaine
Electric Lighting

In Encyc Brittanica 4

Young's Nat. Phil.

Mascart new work

Nature Sept 1877

Jablochkoff

Sake chloride of Silver battery.

between plates sawdust moist and with Chloride of Zn.

Zn AgCl

~~Nollet~~ France

1851 Nollet 24-259

By burning gas produced by electric current

No drawing of light and 10 pages of rambling text.

France

24 – 276 – 7474

Galy Cazalat.

H from Zn and H_2SO_4 burned

"Costs nothing" — Foolish.

Price of $H = 0$

1852
24 345 Watson and Slater p 14

1857 63 – 219

Pulagi a battery

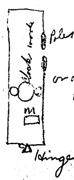
1858 71 – 56

Shepard probably foolish.

Hg. H_2O complicated. NG.

1858 71 174

Serrin. ocillating regulator

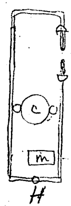


Thrown into gear on one side or other by magnet thus raising or lowering.

Idea good the beginning of a new era

1858 71. - 174 6

Lemin



Poles on frame work hinged on H

C - clock - work

Magnet

Regulateur Gaiffe
see. Figuier Les Merveilles de la Science t IV p 225
Fontaine p. 25

~~Milemann~~

1821 Phil ~~Jour~~ Trans. Vol. 1 p 7 ✓
Davy account of heating wires

1815 Children Vol. II. P. 363
The same

1841 Joule Phil. Mag. p. 260 ✓
Vol XIX Experiments on wire ✓ p.52

1843. E. Becquerel Archives T III
p 181

Ann. de Chim. et de Phys. [3]
T IX p. 21 1843

1859 Zöllner ✓ Baseler Verhandlungen
[3] ~~Bd~~ bd II N. 311 Lit
Light from Pt. wire.

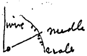
Journal of the Society of A— 1876 8
p. 98
Prof. Cornell to S— A—
Brayton oil engine 6 3/4 lbs per hour 234 lamp power
234 lamps require 16 lbs petro— per hour

J— S of A— 1877-981
account of Mm. Jablochkoff's experiments

Bulletin d la Société d Enc—
Nov 1867 & Dec 1867
Electro-magnetism a full account of what had been done to date by Mm. Le Roux.

Bulletin d S-d E—
M. Lissajous gave a short summary Jan. 1868

De la Rive speaks Vol 1 p 32
of Voltameters made from Pt wire, expand-
ing under heat



Also in vessel of gas or differentially
extending two or three

1840 —— 1850

See page 50

Lissajous
Before 1842 there was needed 9
1. a convenient battery
2. Carbons which did not burn
away rapidly.
3. a mechanism for regulating the
movement of the poles.

— Mr Lissajous gives much credit
to Mm. Foucault for 1844. he
constructed electro microscope.
Duboscq 1849 Serrin
Opera Apr. 16 1849 le Prophete

Le Roux 1868 p 418.
B. S-de

Comptes Rendus d l'academie des
sciences. tome 74 p 1338
to 75 138 627 825

Giin 1878 Comte du Moncel
B — S - dE —

See Baille ~~#~~ L'Electricité for account of lamps in theatre and public places in Paris. Very popular and good

Dingler Polytechnisches Journal 10

1871 No. 6. Page 502 used in illuminating statue of Victory in Berlin

---

Phil Mag 1847

De la Rive Voltaic arc

P M. 1853

Prof Wartmann Geneva

50 Bunsens. Assistants eyes injured

---

arc established by a spark

see Poggendorff 1858 No 8 650

metal resistances

Lighting under water

Comtes Rendus

Mechanical equivalent
Thomsen Poggen — Annal
June 1865
Phil. Journ. 1865 - 246
Estimates that the heat given
out in spermceti candle is 350
in gas flame 1000 times
more than the light.

Unit of work kilo. Metre in one
second. The equiv. of the light of
one candle burning 8,2 grains
an hour is $\frac{1}{34.9}$ K.M. per sec.
or 34.9 candles gives out in
light one unit of work.

see also Silliman's Journal
March 1866

His method was by using a thermo-pile and passing the light through 0.2 Metre of H_2O wh. absorbed all the heat and only 13 per cent of the light.

He used a glass # globe filled 1351 grms with warm water and noticed rate of cooling using Dulong's formula.

Light of a flame of one candle 8.2 grms per hour = energy 4.1 grms H_2O 1° cent. in one minute

1 K M = 7.233 foot pounds

1 Horse power = 33,000 foot lbs per minute

Light of one candle does $\frac{1}{34.9}$ K.M per sec

$= \frac{7.233}{34.9}$

$$\begin{array}{r} 0.85932 \\ 1.54283 \\ \hline \bar{1}.31649 \end{array}$$

= 0.207 foot Pounds per sec

.207 X 60 = 12.420 per min.

$\frac{33,000}{12.420}$

$$\begin{array}{r} 4.5185 \\ 1.0941 \\ \hline 3.4244 \end{array}$$

2652. candles from one horse power theoretically

Wilde Phil Mag. H. Wilde 14
Aug 1867
on researches on magnetism and electricity

Edlund Poggen Annalen
No 8 1867 Phil J— 1869 103
Investigation of the electric light
Work of current

Proceedings of Royal Society
Dec. 17 1868
Crookes Phil - J - March 1869

Royal Society Apr. 27 1871
Charles William Siemans

---

on the increase of resistance with temperature

Phil the same Mag Jan 1875 -79-
refers to Bibliotheque Universelle
Archive des Sciences Physic et Nat 51 - 284 - 287

15

Franklin Journal 1840 speaks of
of Becquerel exhibiting to
the academy of Science Paris.
A Pt. Wire placed in communication with two poles of
~~of~~ a voltaic bat — ~~becomes~~
red hot in a portion of
its length. If that be twisted
spirally all the heat is then
concentrated in the interior of
the convolutions. If a very
small crucible be placed
within the folds of the wire
the greatest conceivable effects
of fusion are produced —
even the Pt. itself may be
melted

Franklin Journal 1840 speaks of

of Becquerel exhibiting to the academy of Science Paris. A Pt. Wire placed in communication with two poles of ~~of~~ a voltaic bat ~~becomes~~ red hot in a portion of its length. If that be twisted spirally all the heat is then concentrated in the interior of the convolutions. & if a very small crucible be placed within the folds of the wire the greatest conceivable effects of fusion are produced even the Pt. itself may be melted

1849 Grove. Pogg. Ann. LXXI 194

Phil Mag XXXV 114

Pogg Ann LXXIII 366

an account of the decomposition of gases in presence of an incandescent wire. Also the effect of H on cooling Pt in it.

) see De la Rive

1849 Mr. Grove in lecture before Royal Institution spoke of cost of the light. And calculated expenses by means of a Voltameter and the estimating materials required

Theoretical expense 50 cells H_2NO_4 Pt. plates 4' by 2 , 2 shilling per hour

actual about 4 shilling

Light = 1444 wax candles about. Central illumination very bad. E.L. good for light house.

Journal of Franklin In 16

1842 Mr. De la Rive read paper suggesting lighting of mines by electricity, Cones of Carbon used

---

Third series Vol. 12. p. 152 Mr. De la Rive found difficulty in producing arc for light see Comptes Rendus 1 and 15 Sept 1845. Grove suggests in the Phil. Journ Dec. for 1845 Vol XXVII p. 442 the use of pt. spiral for light. speaks of common lecture room experiment of igniting a platina wire He says "My plan was then to ignite a coil of Pt wire as near to the point of fusion as practicable

Mr. Grove states:
"The helix form offers the advantages that the cooling effect being lessened, a much longer wire can be ignited from the same battery; by the increased heat, the resistance is still further increased, and the consumption still further diminished, so that, contrary to the usual result, the increment of consumption decreases with the exaltation of effect produced". "The light is perfectly constant, subject to no fluctuation or interruption, and the heat not so excessive as to destroy the apparatus."

in a closed vessel of atmospheric air, or other gas, and the following was one of the apparatus which I used for the purpose, and by the light of which I have experimented and worked for hours. A pt wire [illegible] two or three pairs ~~cells~~ nitric acid combination (Groves)

I nclosed in tube because more light was thus obtained. Mr. Faraday first suggested this. Grove

---

He speaks of difficulties met with in obtaining constant arc, but that he had a light burn for 4 or 5 hours.

Franklin 1848 Journal Vol XV p 445 18
Mr. Staite gives account of his electrical light in
Civ. Eng. & Am. Jounl.
consumed only $\frac{1}{7}$ lb zinc per hour
much cheaper than candles

Staite's Patent in F — J
Vol. 17 p. 263

Lighting work Comptes Rendus
May 1854

Breguet 1858

Cosmos Nov. 1859 n.s.
account of E — L — in light houses

Loss of light by glass shades 19
William King
from Lond. Journ. of Gas Lighting Jn 192

Clear glass	10.57 p.c
Ground glass (entire surface ground)	29.48
Smooth opal	52.83
Ground opal	55.85
Ground opal with painted figures	73.98

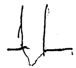
Thomsen estimates loss H_2O and glass as 13. p.c.

Faraday on E. L. Franklin Journal Vol 4 F pp 44 . 147 1860

Way's Electric light 1861
F. J. Vol 41 p 114

In 1861 the electric light was used with Serrin's regulator in various parts of Paris. The success was fair in some of the large squares. Also used under Water. F. J. - Vol 42 p282

1862
Journal F- J- Vol 43 p. 357
A short account of E. L. Faraday had used the lamp with success for lighthouses.
800 candle power with battery costs $3.00 per hour
with magnetos 6 cts per hour
Speaks of Bakers patent machines
upper carbon held by ring and as burning fed.



Ring a little too small for carbon

London Athenaeum Nov. 1862

1857. Prof. Faraday and Prof. Holmes prepared a plan for electrical lighting for the ~~B~~ Trinity house. 1858 trial unsuccessful. 1859 a thorough trial was given and 1860 adopted for the South Foreland lighthouse. Quite full account

London Athenaeum Jan 1863

Prof F. H. Holmes gives clearly the advantages of using the electric light.

Franklin Journal quoting from
Lond Mechanic's Mag Aug 1862
Comptes rendus

about 1730 ~~sparks~~ phosphorescent observed.

Dufay in France sparks. Leyden Jar. Davy.

Proc. Society of Arts Dec 2 1863
1864 Franklin Journal Vol 48 – 409
a full account of the use of the electrical light up to date in the light houses in form of discussion. Dr. Gladstone stated Holland and France had worked on same problem but that Brazil had a light next to England probably He gives Mr. Holmes great credit as the first to use a magneto machine to produce the light. Expense and methods are fully spoken of

23

Tyndall speaks of the heating effect, London Chem. News 271.
Franklin Jn Vol 49 P. 390

Pneumatic regulator F. J. P. 179
Franklin Journal Vol 51 p 185
It is stated that in France the light does not work as well as expected
Electric light = to
125 standard burners of Carcel
oil = 23 " " "
Elec cost 3.84 per burner
oil " 1.52 " "

1867 Aug, Vol ~~53~~ 53

Editorial Franklin Jn Vol. 53 P289.
by Prof. Morton he speaks of Farmer
suggesting the carrying of the current
about magnet to render it stronger

1875 Journal F. I —

Vol. 64 P. 233 Lodyguines discovery mentioned of heating carbon

1876 J. of F. I. - Vol 71 p 273
from Builder Apr. 1 1896 30
Great Northern R. R of France
~~account~~

Journal für Gasbeleuchtung
1876 speaks of the mills at (Mühl-
hausen lit by elec
J. of F. I. Vol 71 p 23
from Electrical news of Nov. 1 1875

1877 J. of F. I.

Aug p. 142 Jablochkoff In doubt experiments not mere refers to 31

Eng. Mechanic June 15 1877

J. of S. of A. June 29 "

Iron June 30

1877 Exeter first recognized the value of E. L. in refusing to buy gas works until experiments had been made.

1878 Letter in J of F. I. Sept 1877 p. 158 describing the lighting system used in a R. R. Station at Paris.

A fine account of "Lighting by Electricity" in J. of S. of A. Vol. 25 p. 976

British Mail Gas Light Journal 1878

34

The electric spark first remarked by Otto ~~H~~ von Guericke Magdeburg. in the last half of the 17th Century

"The physician Sulzer published an experiment, childish in its appearance, but made grand by the consequence on consequence that have been added to it. Two pieces of ~~metal~~ different metals, moistened by the tongue at one end and touched ~~by~~ the eyes, when shut at the other gave the impression of a luminosity:

I think Societé d Encouragement or History of Electricity in the case of the library

Patents
+
Shelf B

In the year IX the "citizens
"Fourcroy, Vauquelin and Thenard
were recompensed by the French academy for a discovery the most
curious and useful of the many Galvan-
ic discoveries, that no matter how many
small piles there may be no heating effects
produced
Fourcroy in experimenting noticed
that large plates ~~would~~ for
were better for fusing though they
gave no shock. The repetitions
affecting this. Ann. de Chim 39-103
Van Marum experimented in same
line Ann. de Chim 40-289
fused iron wire in 1801 and used
it as a test for arranging his
batteries

General remarks. De la Rive &c

A full account of the heating properties
of the current. bringing down to 1855
also a full list of Authorities
Encyclopedia Brit, Vol XXI p. 626
Soon after discovery of the pile va-
rious observers noticed that thin
leaves and fine wires of metals
were fused if put in the circuit.
That the size of the plates and
number of them had great influence
on this phenomena was ~~to~~
~~first~~ remarked. By increasing
both of these ~~in~~ at the Royal
Institution very brilliant re-
sults were obtained. With a
pile of 2000 32 inches square couples Sir H.
Davy could study ~~the He~~
~~manfesses~~ the lighting and
heating properties of the
current to great advantage.
In 1813 the light between
two charcoal pts. was ob-

tained having a dazzling power.
The most refractory substances 41
were melted. Water boiled &c
Mr. Children experimented
from 1809 to 1815. He was
enabled to bring a Pt wire
five or six feet long and a
$\frac{1}{10}$ of an inch in diametre
to a bright red heat. He
also fixed the heating power
of the current in various me-
tals. Dr Wollaston made a
battery in a thimble and fused
wire $\frac{1}{40}$" long $\frac{1}{3000}$" The thimble
was flattened and a piece of Zn. 3/4
of an inch square used.

Encyc. Brit.

Staite and Petrie first 42

Foucault about same time

Breton Brothers, Duboscq, De Bretti

Lacais made apparatus

Light which may be rendered red by using carbons of alder wood.

—Employed optical Exs. submarine insulated with gutta percha. Comptes Rendus 1854-38-813 38 39 1165

Boussingault and DelaRive for miners [illegible]. Grove &c

~~Plat~~ wire used in astronomical instruments [illegible] teng. for exploding cartriges

Biot Ann de Chimie 1820

Vol. 53 p 321 1805 43

Thinks that the light from the spark and its various effects were from the explosion of Electricity proving it by the effects that we explain as following the intensely heating of the air.

~~1824~~ Glasgow Mech. Mag Vol. 1 p 373

It is proposed to light houses and streets with the discharge through tubes. The writer asks who would have thought twenty or 30 years ago it possible to light cities with the jet of H now used for that purpose: the old philosophers lamp.

1839
45

Mr. Weeks in Mech. Mag. for June 1831 suggest the oxyhydrogen lamp for illuminating and ~~if~~ say, "on an elevated station under proper management it might enlighten the whole Town".

18341864

M. Dumas, Bulletin de Société d'Enc. 47 T XI p. 472, in his report ~~on~~ awarding a prize of 50,000 francs to Mr Ruhmkorff, makes the following remarks. Davy ~~had~~ with a battery of 2000 ~~...~~ cups representing a surface of metal equal to 100 square metres, obtained a dazzling light ~~...~~ and could separate the carbons 11 centimetres before it disappeared. Davy ~~...~~ seemed to have no idea that the light could have any practical value ~~a few years ...~~. Mr Dumas ~~had~~ repeated the experiment in his lecture room, ~~and~~ after saying that the light cost then 30 francs a burner each minute, he yet declared his belief that the day would yet come ~~where~~ the employment of the electric light, notwithstanding, would equal ~~that~~ other

methods of illumination; This statement was then received with a general laughter of incredulity.

Mechanic's Magazine Sept. 23 / 1837
Vol. 27 P. 424 48

"A Chemist having found, after many "experiments that a void produced "by electricity in a glass vessel "became luminous, has, at last, "succeeded in forming a long bottle "of 3 inches by 30, from which "having exhausted the air, and "otherwise acted upon it by the "galvanic battery, a light is "now emitted, being hung "up in his appartement, equally "clear, but not so oppressive "to the eyes, as that of the sun.

French Paper.

This one of the first, the first I have found, of many wild accounts telling how rooms were to be lighted.

1839 Sir John Herschel took pictures by the ~~t~~ light ~~of~~ from Daniells great battery Mech. Mag. 33-432.

See Page 15 for Brayward exhibiting spiral.

Page 9 for ~~watts~~ the various failings that must be remedied before the E-L could have a practical value.

The carbon would bend and change under the heat. The diamond was also experimented on. An ordinary bell jar was also used to exhaust the air, 10 Litres.
The carbon cylinders used were from 2 to $4\frac{1}{2}$ centimetres long and 2 mm. thick.

Poly. Jour. V.115 p. 271
Comptes Rendu Dec. 1849 n. 25
(Despretz) Despretz
A thin rod of carbon ~~by~~ placed in a receiver and current from 600 Bunsen cups passed through it. The receiver was so arranged that the air could be exhausted from it and it the filled with any gas wished. Nitrogen was found to give the best results. Under heat the carbon first turned to graphite and afterwards volatalized after continued heating. He used fastening of carbon to fix the ~~a~~ pencils of carbon.
See Konn. S p. 3
Sawyer R p. 26 where Onder is Sawyer now
Kosloff S p. 4
The light is spoken of as being remarkably brilliant and painful to the eyes.

11841
52

Joule Phil. Mag. Vol 19 p. 260.
Shows that heat evolved is directly
proportional to resistance and as square
of intensity of current, in the case of
metallic conductors.

De la Rive suggest lighting
mines by electricity p. 16
This was again suggested by Boussin-
gault Dec 1845 p. 58

Dingler 91 324
1883
54

Moniteur industriel No 766

Delenil used Davy apparatus on the Pont neuf in Paris with 98 Bunsen

48 Bunsen 572 candles

Shadows and expense The light ~~was measured~~ by reading ~~[illegible]~~ at ~~distances~~ an account of the Experiment of Mr. Archereau in (Mech Mag 39-352 1843). He lighted the Place de la Concorde with his lamp. mentioned as a substitute for gas. Easy to read small print at distance 100 yds Paris Paper

1844
55

Foucault new carbons
Compt. rend. d l'Acad. des Science
Vol 18 (XVIII) p. 696

Dingler 95 291
Technologiste V 115
Deleuil and Archereau. 200 Bunsen
in Paris with Becquerel
"Deserves thanks" for calling attention to E.L.

Dingler 97 192 Technol 1845 402
~~Le Herr~~. Weekes proposes the
burying ~~the~~ large plates of Zn and
Fe, in the ground, and thus have
a constant source of Electricity
~~to draw~~ on. 80,000 or 100,000
thus buried and ~~light~~ wires
carried to tops of the buildings, thus
doing. the light should be called
"the light of the Nations."

Bain Eng Patents 1843, No 9745 has similar
plan of burying plates in the earth.

See Page 16 G.

De la Rive claims having worked on the problem of supplying miners with the electric light, though he had not found a form which was thoroughly satisfactory.

Dingler 98–158

Boussingault suggests the same and De la Rive claims are in the form of a letter to him

Mech Mag. 44–349

An account of Starrs lamp as patented by King claiming priority to Grove and especially the use of carbon.

Starrs patent was sealed Nov. 26 1845 in Scotland

Grove Dec. 1 1845 published.

1846 Mech. Mag. 44. 315
King's Patents. Project of lighting from Electricity now a favorite one, not much to be hoped for in this invention.
De la Rive and Grove referred to for lighting mines and long extract given

De la Rive Comptes Rendus Sept. 15,

Year Book of Facts 1846 states that it was proposed to light the city of Cincinnati from two towers as sufficient to illuminate the whole city

See p. 92 H

Mechanics Mag. 45-160 Aug. 15 1846.
"We have another, in Mr. Staite's patent, at 57 tempt, to realize that favorite speculation of the day - a lamp which shall burn without air or oxygen, and be fed by that mysterious agent which we call electricity. Not long ago we gave a plan for the purpose of American origin, patented in England by a Mr. King, and felt obliged to speak of it in terms which have not been gainsayed by anything we have since heard. The present shows a more promising aspect. It shows at least decided originality"

see M p. 5

Plaite in lecture at Cumberland say that his light = 300 candles consumes 3/4 lb Zn per hour.

E. L	costs 1d per hour	
Gas	6d to 8d	"
Candles wax	12s 6d	"

Smelting can be done so cheaply by Electricity say a London Journal Journal, that the change will be prodigious. 2 days required instead of 3 weeks. In Swansea annual saving will be no less than 500,000 tons of coal a year &c.

Penny pieces will be size of dinner plate! Athenaeum 1018

1847
60

Phil. Mag. Vol 30 p 345

Prof. Draper. gives his experiments of incandescence of Pt. He estimates the highest at 2590° F that he measured The intensity of the light at 2015° was taken as .62, at 2590° its was 12.34. "at 2590° the ~~b~~ brilliancy is more than thirty-six times as great as it is at 1900°." He used thermo. pile for the radiant heat which did not increase in by any means the same ratio as the light much lies. He says in closing after speaking of the arm he used for indicating expansion. Says a light of standard intensity is wanted in optics, and "An ingenious artist would "have very little difficulty, by "taking advantage of the "movements of the lever, in mak-"ing a self acting apparatus, in "which the pt. should be maintained "at a uniform temperature, notwith-"standing any change taking place "in the voltaic current".

Jaresbericht über Fortschritte 1847
61

1847 - 1848 p 300 - 314

an account of heating wires and of the light for those years

Mech Mag. 46 June 20 - p621

Mr Staite perseveres and obtains the first practical result. Account general.

Mech: Mag: Full account 1848
saying Mr. Clark worked out 62
his improvements single handed

In Oct 1848 Gas ~~[illegible]~~ stocks fell
20 or 30 per cent. 2/3 of their value.
Created according by Mr. Rutter by
a few cleverly written articles written
for the newspapers

Quoted in Gas Journal

~~1864~~ 91205
Athenaeum 1108 p. 71
Mr. Staites battery not promising, cost too great

Athenaeum for Aug. 21 p. 413. The novelty of the Electric light Staite & Molk passed away; "and the gaslights now shine in their original brightness no longer fearing the eclipse with wh. they were threatened. For the present E. L. gone out from among us. Mm Archereau and Foucault ~~experimenting~~ astonishing Paris with exceedingly steady light — though cost too great.

Rutter quoted in Gas light Journal Dec. 2, 1878. Says that in Oct. 1848 Gas ...

See p. 51 for account Despretz' experiments on melting carbon

Mm R. p. 9 Foucault asks for a commission 1849 63
Jan 15 to decide on his invention as independant from Mr. Staite. He saw account of Mr. Stai — invention Illustration Anglaise for Nov 18 1848. Mm ~~F~~ — carbons were held in place by wheels and a ~~the~~ detent ~~was~~ released by a magnet in cir — cuit. Comptes Rendus XXVIII 68
R p 9 Same vol a word about the commission 698
— The Commission allow that Foucault had independantly invented an apparatus, which was a complete success.
— a drawing Page 9 Regulators.

"De la Rive remarks (Arch. ph. nat X 222) that "he had used an apparatus very much like "Foucaults' for a long time in his lectures." This is doubted. Jahresbericht Fortschritte 1849 p. 213.

Mm. Le Roux. Bulletin de S. d E. 1867 XIV 749. The arrangement of Mm Foucault has been used in the numerous pieces of apparatus constructed since 1849, having the same object.

1849 Mech. Mag Jan p. 50 Vol. 50
"Mr Staites long and arduous endeavours to subdue the lightning from the heavens, &c, are universally known, and we believe we may add highly ~~appreciated~~ estimated by all who are qualified to appreciate them"! Patents follow. R. 6

"Mech Mag Vol 50 Page 92
"M. Le Molt has cut somewhat of a figure lately as a claimant for the honor of first adapting E. L -". All his are old

Paine of Worcester Mass time and H₂O with electricity from turning a handle to spring. light = 4000 gas burners! Year book of Facts 1853
Scientific Amer. Apparatus to be made public after a year

Mr. Grove cost &c p. 16

Pronounced a failure by Mr. Rutter
Year book of facts 1850 p. 187
No perfect regulator, great cost.
Faraday Brit. Asso. spoke of imperfect character of E-L- and unfitness for illumination

The Duboscq regulator Dec. 1850 1851 64
A report on his regulator handed to the academy Guillemin Applications p 676
Comptes Rendus 30 - 367

Despretz Communication on the length of Voltaic ~~arc~~. Longer ~~hori~~ ~~zontal the~~ vertical than horizontal When + pole is on east arc greater than when it is in the west

Athenaeum P. 1255
Allman light worked well for a time of several hours. Proposal to test the light by giving contract to electric light owners to illuminate one of the parks at cost of gas

Mr. Slater's new lamp see next page

1849 Paper read by Mr. Ward stating that the cost of 55 Daniells or 34 Groves 60 grains of Zn per hour cost about 8d.

Mollet experimented with incandescent carbons
Jour. Society of Arts Apr 11 1873. p. 399

Jan. 7 1850 Exhibition of Mr. Staite's light. See Mech. Mag. 52-35.
His Iridium lamp will do very well for domestic purposes.
No unsteadiness of the light perceptible. Correspondent says "There can be little doubt that ere long we shall see gas and oil lighting with all its attendant evils of blacks, heat &c. replaced at least in all large public buildings and thoroughfares by the electric light." Ed. M. M. says "It does appear, that all the difficulties have at length been surmounted and an actual electric lamp produced wh. gives a steady enduring and most brilliant light without any perceptible flickering or intermission."
Before this public had experienced so many disappointments in the "perfect success" the incredulity prevails. We do not hesitate &c

1851
Staite's Electrical light exhibited at Manchester with satisfactory results. Burned five hours and at one time gave light = 700 candles. The products from the battery were claimed to be worth more than the raw materials so that the light cost less than nothing. Year Book of Facts 1852 p. 137

65

Photographs taken by aid of the light. Polly. Central Blatt 1852-177

The light introduced into several R. R. tunnels in England
Mining Jour. 1851 p. 553

Without date
Cunnier and Jacquelin carbons.
1st filling the carbon with sugar coal
~~and pressing and grinding.~~
2nd forming a retort carbon using
only pure materials in the retort.

Allen's spiral electrode ✱ 1852
Mech. Mag. 1852 57 p. 398 66
see R p. 13.

To show the state of electrical theory even at this date one fact can be mentioned. Mm De la Provostaye and Desains, remarked with wonder to the French Academy, that when a wire was placed between two batteries, of like strength, having their poles placed in opposite directions the wire was not in the least heat. This in spite of the fact that either latter of itself would heat it. A discussion followed this and it was spoken of as a matter of question whether the two currents could flow at the same time in opposite directions. Liebig Kops Jahres Berichte
Comptes Rendus 36-342

✱ "Mr. Allen introduced a very excellent rotating electrode, formed with a spiral edge, by means of wh a very superior result was obtained
Mech M— 1857 Vol 67 p. 560

1852

Martin John Roberts experimented upon the transmission of the electric current through a continuous thin piece of graphite enclosed in an exhausted glass glob

Jof. B-of A- Apr. 11 1873 p 349

Tuchsenbrauft 1853 1853

67

refers to a paper by Crahay giving an account of lamp Institute, 1853, 337 also refers to lamp of Jaspar of Luttrich

Pekárek in the Sitzungsbericht of the Vienna Academy describes a ~~new~~ form of apparatus like that of Achereau.

A core of iron in a spiral governs by means of cords and ~~or~~ wheels the distance of the carbons.

Wien. Acad. Ber. XII 263.

Cost of Electric lighting Deleuil

Deleuil Comptes Rendus

1854 p 812

The Napoleon Docks.

The lampes ~~ha~~ were in operation during four months, and worked very regularly, having a battery of 50 ~~Bun~~ large sized Bunsen cells.

Two sets of apparatus each one costing per day

	fr	
Wages	4.50	
Mercury	5.00	
Zinc	4.50	
Carbons	1.40	
Nitrous acid	1.80	
Sulphuric ac	1.84	
	19.04	
	2	lamps
800 laborers	800) 38.08	
	$4\frac{1}{2}$ centimes	

Useless [illegible]
5.00
1.40

The economy is considerable and the work proceeded without danger and with greater regularity than by any other light

Mr Despretz obtained a changed state of carbon on at Pt. pole using a low power current.
Perhaps diamonds, as they could be used for polishing rubies;
Mech. Mag. V. 59 — 386

Slater & Watson R p. 14.
Jaspar R p. 15

Year Book of Facts 1855 p. 190 from the Builder No 623
Dr. Watson of the Electric Power, Light and Colour Co. lighting the new bridge at Westminster.

Proposed lighting Champs Elysées

Light = 72 Argand worked quite well. Moniteur Universel
Poly. Central Blatt 1855 - p. 375

Proposal for lighting Chelsea bridge ~~for~~ in building, for divers under the water.
Poly. Cent. Blatt 1855 - p. 1272

In Rome ~~from the~~ on the tower of the capitol a light having one of Jaspar's regulators was tried. The dome of the Vatican was brightly lighted as if the sun were about rising. Father Secchi tried the light by reading, and found that he could do so knowing at distance of 700 meters Comptes R XL 834

Machine d Alliance
Bulletin de S— d'E— 1867 p. 696
The idea that prompted G° Co. who gave the money to perform the experiments ~~to~~ build this machine was that ~~the~~ ~~m~~ it should be used for decomposing H_2O into gas wh. could be utilized ~~afterwards~~ for illuminating purposes.

Duboscq's regulator in its improved form. For full account see Karsten's Encyclopedie Vol XX Allgemeine Electricitatslehre p 1316 70

For Serrin the same p 1320

Deleuil see R p 8

In England experiments were made on various lights for war purposes. The apparatus for the Electric light took a two horse wagon to carry it 1855 thought light the best. Year B— of F—

Querini proposed placing lamps in line after each other. light not good Poly Central B— 1856 p. 379

1855.

M. Viard Ann. de Chim. et Phys. (3) T 43 P. 304

Proof that the amt. of heat from a wire depends only on the current passing through it.

J. Grove ~~Joule~~ had found in experimenting that when the wire was placed in H it rapidly cooled; one explanation was that the H on its surface helped ~~it~~ conduct the current, another was that the H could easily take up the heat from the wire and thus reduce its resistance, more current could pass and the ~~wire~~ heat developed in other parts of the circuit. If the same amount of heat was developed in a given current passing through the same resistance of Pt in H as in O second explanation correct

Clausius Pogg. Ann. 87 – 501. explains this phenomena with equations of conductivity of wire and absorbing power of gases &.

1856

71

At the crowning of the Emperor Alexander in Moscow Aug. 1856 eighteen electric lights were placed in the Bell Towers of the Kremlin. The system used was that of Prof Spakowski of St Petersburgh wh. worked so well that the lamps worked perfectly for 4 hours and a half, and only two of the eighteen needed to be attended by hand. Bulletin d. S. d'Encour 40 cups each Deleuil large size 1860 p. 197 see R p

Father Secchi of Rome, made in this year, a series of experiments to test the practicability and the cost of the E. L. for lighthouses. The expense of the various batteries was formed, 30 Bunsen cells cost 6 1/2 Thalers, and could be used for eight hours. The Bunsen form was much better than the Daniells though that cost 5 Thalers.

The cost for the light must greater than the ordinary oil-lamps, while ~~the~~ unforeseen trouble as impurity of the carbons would break the light. The cost would be at least for each night 6 Scudi. Finally the light is not so strong as to do away with mirrors or lenses in order to concentrate it." Therefore after all, the hour does not seem as yet arrived, that this agent can be used as an economical means of producing light"
Berlin Jaresbericht XII. p. 463
from Cimento IV 321-396

Proposed to use under H2O to attract fishes at night Poly. Jour. 141-400
Hall lighted Mech. Mag. 67-250

1857
72

Light houses see ~~A~~ p. 21
Faraday experimenting
Great Eastern Launch proposed for
Mech Mag 67-559
A summary entitled The Electric constant light.
If continuous motion given the light soon extinct. Passing current only governed on cessation of current very inconstant, fluctuation varying with friction.
Use of ~~disks~~ abandoned because of liability to crack or fly from unequal expansion. Then speaks of Harrisons new light of pencil and cylinder of carbon as being good small light for
Used in Dunkirk for fishing the carbons placed in a glass globe: fishes swarmed round the lamp.
Jour. Soc. of Arts 1864. 757

1858
73

Dr. Watson used his light to light the work on Westminster bridge = 72 Argand burners. Eminently successful. "It should be added that the new light was subject to a transient and occasional flickering, fluctuations of electrical force ... inseparable from the operation of so subtile an agent" Year Bk of F. 1859.
Cost nothing products valuable!

Mr. Lindley read paper Society of Arts March 3 on E. L. He said great hope had been felt of Moser Station and Petrie. Harrison light very good. Mr. Holmes introducing light in light house Mec Mag 68 L 252

Mech. Mag. 68 – 36 Letter from H. Chapman on E. L. stating what had been done and classifying regulators — not very good.

M. M. p. 48 1859

Harrison E-L. 74

The Way ^Hg^ E. L. only gave about $\frac{1}{20}$ of the light of the carbon points and was subject to a painful flickering. The vapor from the lamps at last killed Mr. Way. Scien Amer. VII-279

Silbermann et Favre

Cost Zn 15 times C

Thermal equiv $\frac{1}{14}$ C

For burning $14 \times 15 = 210$ more costly to say nothing of the acids.

Light House p. 22 1860

A paper Prof. Faraday, Royal 75

Institution March 9, 1860.

Summary Year B. of 7 1861 p. 86

The great advantage in the diminished size of flame allows it to be refracted by small glasses.

A summary and account of the light in the light house at South Foreland

Poly. Journ 157–113

Söchting Pogg. Ann. CIX 182.

new regulator iron stem and magnets no cut

1861 The electric light used in several places in Paris at an alleged lower cost than gas Yearbook of F– 1862 p.170

Mm. Faye Comtes Rendus 52 – 375. 413 speaks of success attending ~~the~~ exhibition at the Tuileries. Suggest for light house. To avoid the ~~glare~~ glare from the lamp suggest a hemisphere over them ~~being~~ upper part a mirror lower ground glass

O photometre of M. Becquerel Annales de Ch – A P. 62 – 14

1862
76

Lantin was a simply a ~~sh~~ laboring shoemaker who in odd moments amused himself in making an electric lamp. Societe d'Encour. 1862 – p. 273

Gramme cabinet maker.

Note on cost of lighting with ~~by~~ Serrins on RR work in Spain Bulletin de Societ d Encr – P. 373. light had been used for 12 hours and worked well cost per hour for 2 (8) lamps 2 fr. 81

Serrin Comp. Rend 54 – 741 claims only an oscillating system

El L permanently fixed June 6 in the Dungeness lighthouse

E. L. has the power of affecting the growth of vegetables Scien Vol V p 181

Hervé Mignon Herve Mignon ..

M. Becquerel estimates cost of lights as follows

gas costing $\frac{30}{100}$ fr cubic metre

17 cts 100 cu. ft.

oil of colza $1.28 per gallon

Tallow in form of candle 16 cts per lb.

stearine 36 " ....

wax 52 .. .. ..

Cost of E-L - simply materials

900 candles per hour

L produced by machine 264 cts.

Galvanic battery 386 94

Coal gas 62

Kerosene 73

pure oil of Colza $1.14

Tallow candles $2.37

Stearine 5,00

Wax 6 10

Popular Science V 720

Interest extra, labor &c left out of account in E. L cost only fuel considered

U. S. Commission 1867 III 452-5

These figures Dingler 217-347

Adopted for a light on Cap de la Hev near Havre and working well.

Advantages when the weather is half misty it possesses immense penetrating power, and only costs one third more wh. in comparison to the cost of the light and interests involved may be neglected. Ann. de Tel. VI-369.

Parliamentary paper on E. L in light houses stated that it cost $3.620 per annum, Only extinguished twice in 9 months for two minutes and 30 seconds.

Scien Amer X-49

Bulletin de Société d Encour.

Mm. Dumas Bulletin d S d E XI p. 473 1864

78

"How can one ~~help~~ attaching an extreme importance to this extraordinary production of a luminous point, which, without consumming of material and without chemical action, ~~is can contend with~~ is superior to that ~~from~~ which 200 or 250 carcel burners are able to produce, that is to say 1500 or 1800 candles, and concentrated in the small space that one occupies."

Lavoisier, in his memoir of the lighting of the city of Paris, makes the remark, one hundred years ago, that it would be necessary to have very many small lights in order to light well a city and not those of great power and few of them.

But in mines, tunnels, light-houses, for military purposes

~~the~~ the light could be used without this troubles if a suitable method of regulating could be found. Mm. Foucault remedied the fault partly by substituting ~~gas~~ carbon from the gas retorts, and Mm. Jacquelin a prepared carbon.

There was wanting a regulator for the apparatus, and it Mm. Foucault who the principle in the following combination: the current which produces the light traverses in its route the turns of an electro magnet, and communicates ~~it~~ magnetism to it. One sees this from this, that if the communication ~~of~~ between the carbons is established, the luminous arc is intense, and the current passing through

Mm Dumas
the conductors, the magnet 80
~~has~~ has its full power. If
the carbons separate, the light
is enfeebled or extinguished,
the current is weakened or
broken, and the magnet loses
a part or the whole of its
power. But then a contact
which the magnet holds is
broken causing the carbon to
approach, until the current as
well as the light are brought
into play another time.

Mr. Staite solved the same
problem mechanically.
Mm. Serrins regulator very
successful; Duboscq also with Mm
Foucault. It is not the first
time that Mm. Foucault has
been able to say the first and
the last word on a diffi-
cult question.

Dumas Bulletin d S. d'En. XI. 474 1864
Speaks of Electro Magnets 81

Light used Lorient France
Scien. Amer. XI 275

Edlund shows how the total heat of induced current and main current follows the laws of intensity square
Poggen. 131-337

Edlund. An electromotive force exerted in the arc in the contrary direction. Poggen. 131-586

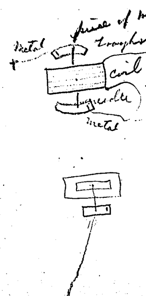
Dec. 26. 1863 the electric light established first phare de la Hève. After two years crowned with success Nov 25 1865 second light. The apparatus of Mm. Serrin worked most admirably. It had been employed in very many works and always did well. 10,000 hours.

M. Bazin tried the electric light to fish by and found it very successful. He was ~~put in~~ given a government vessel to use in trying experiments to try experiments on coral fishing in Algeria.

1867

Kohlrausch Poggen 132 - 266

a self acting regulator for the galvanic current. A needle has attached to its ends ~~to~~ pieces of metal dipping into a fluid through which the current must pass. As the needle is affected by the current which passes round it the plates in the fluid are moved and resistance change



As the needle moved the resistance was greatly changed

see page 15 M 1867

84

Used on yacht of Prince Napoleon and skating pond Bois de Boulogne. Growing accustomed to it every day. M. Serrin regulators used

Mech Mag XVII p 84

The E. L. from Wilde's machines said to be more powerful than sun light

Scien. Amer XVI-248

Mr. Farmer's estimates as to the cost of the light see S' p. 15 from Scien. Amer.

The E-light was placed on the battery in New York for a short time this fall, using a third class Fresnel lens to project it Scien Amer XVII

Edlund shows that a Pt. wire expands more for stronger current than a weaker one though the temperature of the wire be the same Poggen. 131 - 337

The St Laurent showed nightly the electric light. It was said ~~to~~ cost about ten cents an hour.
Scien. Amer. XIX - 250

The cost is estimated in Popular Science Monthly V 723 as 56 cts per hour

In the report of the U. S. Commission on the Paris Exposition for 1867 by F. A. P. Barnard a fine account is given of the E. L. in the French light houses and the cost &c, with figures as to its value. Vol III p. 415

Edlund gives an account of the measurements of the polarization of the arc. Poggen. 134 - 250

Mm. Carré proposed ~~a new~~ an improvement in the carbons 1869
~~which emitted~~ by soaking them 86
in certain saline solutions. The
light from such carbons was to that
of the ordinary as 1.68 to 1,
M. Jamin Bulletin d S— d E—
XVI p 69

Mm. Carré was the inventor of the
process of making ice artificially

In Sept. Mr. T. Stevenson C. E. engaged
in the project of illuminating buoys
with the E. L. J. of S— of A April 11. 1873 p. 379

The electric light used ~~by~~ by both the Germans and French during the war. Particulars as to the distances illuminated in Jour. Society Arts Nov 18 1870 1770

Used, in sending signals from Wales to Ireland for survey Mar M. Vol 24 p. 202 proposes that harbors should be lighted with Electricity

Poggen 140-337 account of the effect that the surface has on the radiation of heat from bodies

An account of E. L in J of S of A 1872

A Apr 4 & 11 1872 p. 381 398 89

He says an inventor is trying by using heated carbon to obtain E. L and that the mains of the gas companies will soon be used for carrying the wires

E. L like artificially Sun. Light.

"It is most probable that the adoption of the continuous conductor principle will admit of two or more E-L on the same circuit. Most certainly if this invention becomes in very deed and in practical working an accomplished fact, our analogy will be carried out, and we shall have our houses and streets with a light wh. in a philosophical as well as a practical sense is truly described as artificial sun-light."

Light with the Gramme Machine used Westminster bridge.

proposed clock tower Parliament.

Jo of S of A. Apl. 21 p 779 account of Kosloff light in St Petersburg

Used in Clock tower of Parliament
Pictures of apparatus Scien. Amer. XXIX-40

Poggen. 144-467 an apparatus by which the expansion of Hg in a thermometre controls the amt. of gas to a burner, thus regulating temperature.

1873
90

Gas and Electricity used in the clock tower of Parliament. Result in favor of electricity
Scein Amer XXX 372

In the Pop. Science Review Vol. 12 p. 265 a very good account is given of the Gramme machine and of the lighting the tower at Westminster. Mr Werdermann introduced the machine in England. Serrin regulator used.

Poggen. 148-427 Theory of the evolution of warmth by the current, Edlund.

Poggen 149-521 No direct relation of the amt. of material carried across in the arc to the current.

Poggen 150-368 The alteration in length of a wire by a current passing through it. Streintz.

J of S of A. Vol 23 1874

p. 234 91

Poggen - Jubel Band Bunsen Photometre

2

1879

Prof. Osborn of the Miami Univ. used a ribbon of carbon in air of CO_2 suspended between Pt supports. Iron Vol 3-654

Mr. Starr of Ohio invented this lamp, patented by Mr. King in England. Mr. Starr died very suddenly in the midst of his experiments. "I assisted him" W. Mattieu Williams.
Iron Vol. 3-684

1859
C. H. Hassenstein. Das electrische Licht. Weimar B. F. Voigt
p. 1–194 nebst 15 Tafeln

Bolley Handbuch Chem. Technol.

Jahresbericht des Physicalischen Vereins zu Frankfort
1864 bis 65 S. 75

An account of a regulator for the current

Close account of E. L. in light houses

1857
Archives Phil. Nat.

Cosmos

Archives d. sc. phys
Recherches sur l'éclairage électrique
36-310 Sherry
Wartmann Sur l'éclairage électrique
36-323
E. Becquerel Elairage électrique
Cosmos X 417

Lumiere Electric
Du Moncel Exposé III 216-287

Poly tec Notiz Blatt 1857 - p. 84
lighting Elysian fields
Fortschritte der Physik after
1856

List of Authorities not in Astor

Baseler Verhandlungen II P 311 (P. 1
Zöllner light from Pt. wire

Archives de l'Electricité very many
references from De La Rive Vol. 2 p. 334
especially Fizeau and Foucault
Electric light t IV p. 311

Cincinnati Magazine for account
of lighting cities by Electricity. ~~for~~
Year book 1846

Electrical Mag. Jan 1845
account of how to light towns
with Elec.

Institute No. 960
account by curtet

Rutter. Gas lighting London 1849
account of Rome in gas stocks

Gmelin Handbook
Vol 1 p. 393. 421.

Institut 1853 - 337 account of a
regulator by Crahay

$$\frac{\mathcal{E}}{(R+r+r')=S} = \frac{\mathcal{E}'}{R+r'}$$

$$\frac{\mathcal{E}}{R+r+r'} = \frac{\mathcal{E}'}{R+r'}$$

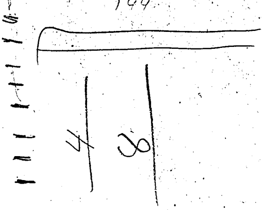
4 horse 400

9 1200 $\frac{1}{3}$

36

16

144



Jablochkoff. C.R. 83 - 813 - 1896

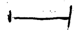
84 750-752

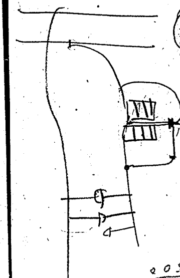
84 137

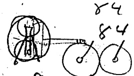
84 2#8

84 346

84 914







Dingler 224 - 494

Les Mondes 1877 - 44 - 412

977°
32
9)945
105
5
585

Use of Belting Cooper
$2.75 looks good

Palaprat translation Labaume
Pt. wire for cauterizing.

Chapman's patent how related to Lemis

Silliman's Journal E. L in
Boston 1862 or 63
Amer. J. of S and A ditto

Nature account of E. L in
lighthouses

U S Commissioners report for
1867 light house

M. Becquerel on Electrical
apparatus in Paris 1862

Faraday's life Gladstone

Comptes Rendus Dec 2 1872
account of Gramme Machine

M. C. Close has an account of the lighthouse experiments in England

Outlines for history

Galvanism   Heating substances

Page 48   Account of heating substances

Cautery

M Header 1895 see p. 2

De la Rive Vol III 687

Middeldorpff p. 2

Strange things

Running gas from decomposition P. 4 H

p. 5 H

Electric explosion &c p. 43 ~~H~~

Weeks burying plates p. 57

Lighting Tours 59

Applications Guillemin app-
first & large work reconstruc-
ting the Notre Dame Bridge
in Paris. Opera. During
the war at Mt. Valerian.
Ships Transatlantique, picture
~~for~~ Miners with pictures for
all

E6285-2 N-(78-11-16.2)

Drexel 3rd
Room 44 Broad St
Porter Lowry Sumner
& Stone

M. M. Mechanics Mag
P. M. J. Practical M. Jour
L. J. London Journal
Newton's conjoined series
R of A Repertory of Arts

—595 123

Francis R. Upton
115 East 14th St.

$2.00 reward will be paid for return of this book if found

Materials for
Carbons

Outline for History

E6285-2

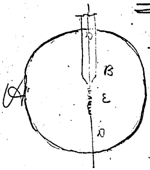
1841

De Moleyns No. 9053

He says the usual mode was —
Pt. charcoal pts. or one Char-
and pt. wire, contact made
in vacuo or atmosphere; arc
ceased after few moments

His invention C powder & in contact with hot pt wire

A Glass globe for vacuum



Wires D of Cu leading to Pt spirals E wh. may be made white hot when contact is made. A piece of spongy pt. is placed in ~~top of the~~ one of the spirals to facilitate this. The tube B is filled with Charcoal or plumbago powder which falls through

the spiral and is thus heated. 2

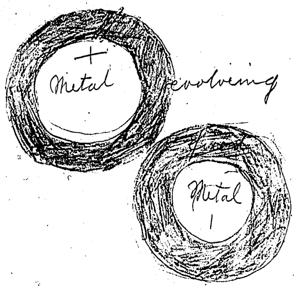
~~He~~ says a light "pure and intense" is obtained by this means

Mechanics Mag
Vol. 36 p. 236

1845 March

Wright Thomas No 10,548

~~Class~~ Rotating a circular disk of carbon against another. Claims "method" of presenting continually one or more fresh pts. or surfaces of C. ~~or of~~ to the path of the Electric light



London Journal Vol 31 p 194

E. and A. J. Vol. 11 p. 355

Fontaine p. 17

This is probably what the Sun had reference to of Nov 21 Dec 2, 1878

The writer probably refers to the invention of Staite in 1848, where the poles are regulated by clock works controlled by a magnet.

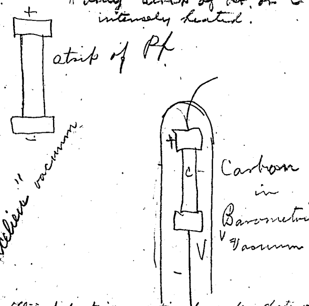
1845 No 10.919

so said by the Ther

King for Starr of U.S.

Claims application of continuous metallic and carbon conductors intensely heated by the passage of a suitable &c

No regulator mentioned claims only a strip of Pt or C. intensely heated.



This patent is mentioned under date of 1848 in (Gas Mag Journal) Nov 1878 as giving a start to invention ?

1846 Greener and Staites 11.076

"Prisms or cylinders divided in the surface into numerous acute points, or by means of ~~of~~ rods or strips of Pt."

Points on surface given with saw

Claims — "The employment of carbon or Pt. or any other like difficultly fusible metals in solid prisms or cylinders divided on the surfaces into numerous acute pts. or other forms as to present numerous acute pts." Like Wallace lamps?

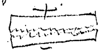
"By opposing two such asumated surfaces the one to the other, we secure the advantage, that should the electric current, between any two pts. (as happens frequently in the ordinary mode of igniting C by E— when there are only two pts in opposition) the currents will be kept up by the remaining pts and the light so maintained without any material interruption or abatement.

G 1846 5

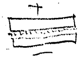
Greener & Staites 11,076

No drawing

~~Hollow~~ Prisms or cylinders of carbon in contact with surface roughened

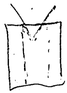


Separated by pt gauze



Pt Gauze

Cone in hollow Cylinder



Both of Carbon or either of Pt.

Method of preparing C purifying with acid.

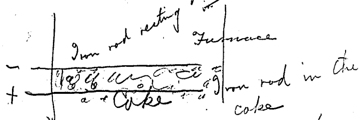
Greener & Staites.

"This apparatus requires to be in Vacuum. Previously no pure C. could be obtained ∴ glass soon covered with black.

Method of preparing C —

Churches Patent for coke and coke ovens ±

Elec.



Current passed 2 hours when coke is cooling.

claims that 11/12 impurities removed 7

Greener & Staites digest Ch C in Nitro Muriatic acid wash, neutralize, wash. Hydraulic press into shape.

Then heat, intensely 24 hours.
Indent with same

London Journal Newton
Vol. 29 P. 157
Mecha. Mag. Vol 45 p 160
Pat. J. Vol. 1. p. 216.
E. & A. J. Vol. 9 p. 285.

For Jabez Church sea 8

Repertory of arts Vol 8 p 224

M-M- Vol 45 p 121

P M J Vol 1 p 204

P J Vol 1 p 77

E & A vol 9 284

No 11,449 gives improvements

powders of coke and coal

mix. Heat and compress.

Plunge into concentrated soln

~~of sugar.~~ Dry and heat very

hot

L. J. Vol 33 pa 390

P. J 2 886

Palapret trans
Lobaume
Pt. wire for carbon
[illegible]

Chapman's patent
in relation to
Perrin's

Silliman's Jour
E. L. in Boston
1862 or 63

Amer. J. of S and A.
1863 account of E. L
in Boston.

Staite 1847 No 11,783

Plunges Carbon into melted
sugar instead of solution of.

12,272

Plumbago washed acids
Lampblack
Charcoal powder
Gas coke

Mixes with brown sugar
enough to form paste [illegible] heated.
Mixture melted and boiled
until stiff. Pressed while
hot into moulds, the inside
of wh are lined with plaster
of Paris to prevent mixture
adhering and allow gases to
escape. Moulds heated
gradually until dry
and then to red heat.

Nature account of E. L. in light houses

U. S. commissioners' report for 1867

M. Becquerel on electrical apparatus in Exhibition of 1862

Staite 1847 No 11.783

Plunges Carbon into melted sugar instead of solution of.

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Staite 12,212

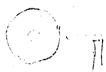
M. M Vol 50 p 49-73

Artizan	7	26
P J	6	146
E & A	12	53

~~1848~~

Le Molt 12,219

Two discs at right angles
clock work



✓

France 1849 16-223

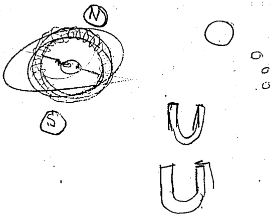
K of A	Vol 13	p 166
L J	34	31
M Mn	50	91
Artizan	7	132
P J	6	153
E A A	12	80

1853 634

Starts

Boil C – in oil [illegible]

and [illegible]



308.2
32
9)3050
340
5
17000 Cent. fusing Pt

180
100
9
5

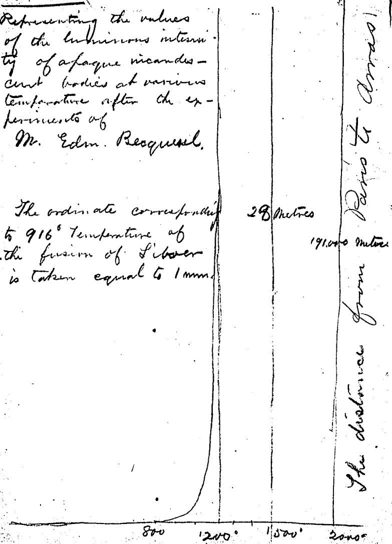
H&Rl.

Curve

Representing the values of the luminous intensity of opaque incandescent bodies at various temperature after the experiments of

M. Edm. Becquerel.

The ordinate corresponding to 916° Temperature of the fusion of Silver is taken equal to 1 mm.



M. Edmond Becquerel has ~~sough~~ sought in one of his principle work to fix the value for the various sources ~~ha~~ of light and at the same time their luminous intensity. He could do this directly up to a temperature of about 1200° cent. These are the results of his experiments

~~Temperature~~	Intensity of light
500°	0.0
600°	0.003
700°	.02
800	.13
900	.75
916 silver melts	1.
1000	4.
1037 gold melts	8.
1100	25.
1157 copper melts	69.
1200	146.

By an empirical formula, supposing that it will hold for higher temperatures one obtains

1500°	28.900
2000°	191.000.000

or 2000° is approximatively the temp. of the Voltaic arc, which

had also been concluded by M. Becquerel from comparisons with a Carcel lamp.

These numbers show that towards these high temperatures a slight change in the temperature will cause a great variation in the intensity of the light emitted, especially near 2000° That is it varies $\frac{1}{10}$ of its value for a variation of 23° Cent, 10° added will double the intensity of the light

Without doubt there is not an absolute certainty in these results, for they suppose that certain laws exist outside of the limits for which they have been proved.

If ~~two~~ one imagines two surfaces of equal area, ~~flat~~ one mm. square for example; one of them illuminated as strongly as the brightest part of the voltaic arc, the other covered with a coating of fused silver, the first will give out 191,000,000 times more light than the second.

It must be distinctly understood what is said. 191.000 000 to one. The arc that generally is ~~found~~ produced has a surface towards one side of about 1 mm. square

Imagine a surface of 1 mm. sq of fused silver placed one centimetre from a screen and find how far a source of light of the same size must be placed to illuminate the screen to the same extent

As the illumination varies

inversely as the square of the distance, it will be at a distance = $\sqrt{191000,000}$ or 13,000 centimetres, or 138 Metres which does not seem improbable, and this result offers nothing of the paradoxical!

This is taken from one of two very fine lectures on Electro Magnetic Machines and the E-L in light house by M. ~~F. P.~~ F. P. Le Roux to the Société d Encouragement. 1867 page 798

Annales de Physique et Chimie

Vol 68-4~~9~~ - 143

49-143

Outline for History

A short account of the discovery frog legs being the sensitive instrument.

Voltaic. Arc

Davy quite full

Theory like an account of what it is

Date of Grove
Bunsen

Regulators follows new lights account

See next page

Probable that Pt fuses
between 1560° and 1580°

5 / 1560
312
9
2808
32
2840

Palladium
1460° 1480°

Iron 1450° 1500°
not exact on account of the
oxide forming on the surface.
Becquerel Annalles de Chim et P.
68

Carbon arc
2070°

~~Heating~~
~~Discovery~~
~~Heating substances~~
Becquerel

Intensity of Light	Temperature deducts from the light emitted
0	500°.
1.013.	972°.
2.331.	1050°.
21.630.	1260°.
41.625.	1321
58.695.	1354
145.835	1440
205.510	Melting Pt

and probably much higher

FRANCIS R. UPTON COLLECTION

CORRESPONDENCE AND OTHER UNBOUND DOCUMENTS (1878-1918)

FRANCIS R. UPTON COLLECTION

1878

E-6124-1

1

23. Clinton St

115 East 14th St. New York
Nov. 7. 1878

Dear Mother:

I have asked if I could have a place, and am to receive an answer Saturday. At first I will have a desk in the office and do such work as may fall to my share. No pay to start with. That is if anything is found for me to do I shall have it. Afterwards I may have a chance to take charge of a telephonic system in some city; at first I shall have clerical work to do.

The struggle has been a hard one to give up my plans for the future. I have dreamt of being a student and leading a quiet life, now I shall change all. I feel sure I shall make many failures but I hope none bad enough to bring me in bad name.

Mr. Butler has been very kind to me and he introduced me to the Vice President who is an educated man. I shall probably have a fair trial and will soon find out how matters are. I wonder what Lizzie will say when she hears that I am going into business.

& I felt that though Germany would be extremely pleasant, yet it would be much more like getting settled in life to commence doing something. There I would only learn how to spend money here I will learn how to earn it.

I am going to try hard and break my absent mindedness, for that would spoil all.

I telegraphed this morning for some clothes. I am now in the same boarding house with two of my classmates Sargent

and Curtis. I am paying about $6.00 a week. If you see the Telegram belonging to Curt I wish you would send it. I hope for a letter from Lizzie this week.

Everyone must work and it is not always the most agreeable thing in the world.

I am very much pleased to hear that Father is so much better. He must be sure and be very careful.

Please tell me about Maria and yourself.

I am With very much love Your Son

Francis R. Upton

X-E6285-5
(1878)-11-22

115 East 14th Street
New York Nov. 22

Dear Charles:

Your letter received this morning, thanks for the trouble you have taken. I am glad Maria is feeling better and hope that she may be very well when I come home for thanksgiving.

I find my place here extremely pleasant, and I am learning a great deal concerning the Electric Light. I will tell you about it when I reach Peabody.

Yesterday the Co. sent two messengers to me to ask

me questions as to an English patent. That shows, that they are having no other searcher, and that I have a fine chance of coming into a good position, if the light succeeds. My pay is not yet fixed, but I hope it will be so in a day or two. I cannot really believe that I am earning money.

I enclose order for the amt. sent on the Warren Savings Bank.

I am Your Brother
Francis R. Upton

E-6124 — 2

115 East 15 St New York
Dec 12 1878

Dear Father:

I expected yesterday to go to Boston to spend a few days and to spend my nights at home. I received a note from Mr. Edison's clerk yesterday, saying that Mr. Edison thought there would be no need at present of going, so I expect to-morrow or Saturday to change my residence to Menlo Park. The reason that I had for expecting to go to Boston was this: Mr. Lowrey who has the oversight of the doings of the company here thought that it might be well for me to make my search fully complete, and look up everything that I could think might contain any hint as to the Electric light. I did not have much hope of finding anything and from

the note of Mr. Edisons, he does not seem to also to hope for much. I confess I am disappointed as I should like very much to spend Sunday at home. I expect the first few weeks will be lonely enough, for Menlo Park is such a dreary place. The work will of course ~~tho~~ keep my mind full, and away from home-sick thoughts.

I will try and write you often telling what I do and see; and if you keep my letters I shall have a diary telling ~~of~~ about how inventions are made.

I am with very much love
Your Son
Francis R. Upton

X-E 6298

Copenhagen 20 Decbr 1878

Wm. Hellesen.
COPENHAGEN.

T. A. Edison Esqr
Menloo Park
New Jersey
U.S. America

Sir.

Being one of your sincere admirers I should be very glad if I could contribute to a succesful issue of your present endeavors. I therefore beg to enclose a sketch of a contrivance for checking the current passing through each lamp to which I have added some suggestion aiming at the punctum punctorum: the economy. – If you find any of my hints useful I shall feel flattered by a line from you saying so.

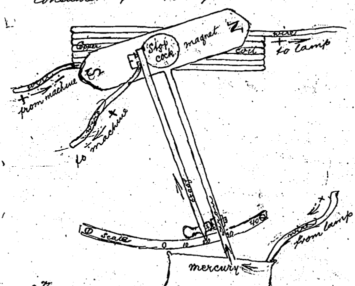
Yours respfly
W Hellesen

Upton to answer it
Edison

1 Encl

[ENCLOSURE]

Regulator controlling the electricity consumed by each lamp. —



The magnet is inside the coil and the stop-cock (on a tube not indicated) outside. The brass arm on the cock must be bent, so as to touch the ironarm (dipping in mercury) near the scale, by a silver contact. The whole is a galvanometer, an arm of the needle of which being inserted in the circuit will interrupt the current the more effectually the nearer the contact is to the zero point of the scale. The contact arm can only move to a point where the interruptions caused by the normal current just cease, and if the current increases new deflections will protect the lamp. The stop-cock will allow more or less of a fluid (glycerine) to flow down in the metre according to the electricity consumed. —

X-E6298
1878-12-(20)

If in a dynamo-electric machine the wire of the inductor has a resistance of 1 that of the electromagnets will generally be made equal to 3 or so, and of the outer circuit 4, together 8 units of resistance. Call the electromotoric force ~~1~~ the intensity will be $\frac{1}{8}$. — If the copper of the inductor be stretched to the double length its resistance will be 4 and the el. force 2. and if a permanent magnet of same power be substituted to the electromagnets the intensity with an outer ~~circuits~~ resistance of 4 will be $\frac{2}{8}$ or the double of the former without a greater expenditure of work. If the permanent magnet has only half the power of the electromagnet the magneto-electric machine will yield the same current as the dynamo-electric but the former will only require half steam-power against the latter. — A magneto-electric machine may have the simplest form of inductor and commutator if used for lighting purposes as ~~here~~, short interruptions of current are of no consequence. Incandescent wires ~~in~~ the lamps should be surrounded by some transparent substance preventing radiation of heat (Alum etc)

Decbr 1878

R W Hellesen

X-E 6285-5
1878-12-29

Laboratory of
Thomas A. Edison
Menlo Park, N.J.
Dec. 29 1878

Dear Charles:

I enclose you the draft on Paris which I wish you would get ~~at~~ cashed for me and send me a New York draft. I am getting along finely here enjoying myself very much indeed with my work. I ~~ast~~ learning how to sleep daytimes.

I have just finished the night and and am now going to bed. With love to your family I am Your Brother

Francis R. Upton

Jan. 1 1879. A Happy New Year! The check did not come as I expected the day I wrote you and I now enclose. I should be much obliged if you would send me a New York check. Still at night work and find it hard work.

Jan. 1 1879. A Happy New Year! The check did not come as I expected the day I wrote you and I now enclose. I should be much obliged if you would send me a New York check - Still at night work and find it hard work.

T. A. EDISON,
Menlo Park, N. J.
Dec 29 1878

X-E6285-5

JAN 1 N.J.

Chas. B. Farley Esq
Peabody
Mass

FRANCIS R. UPTON COLLECTION

1879

T. A. EDISON.

X-E62855
1879-01-22

Menlo Park, N. J., Jan 22 1879

Dear Charles:

I enclose you the second draft, which Cart has just sent me.

My dividend on the Gold and Stock ~~tel~~ was sent me in the form of a New York check. I think it is a good investment especially as they own Mr Edison's inventions and he has just finished a receiver for his telephone which will beat anything known.

I am with love your Brother

Francis X. Upton

E-6124-3

Menlo Park Feb 23 1879

Dear Father

Yesterday I was in New York. I went in Friday to see about getting my effects through the custom house and to attend the Alumni dinner. I found the ways of the custom house very dark, I tried hard to tread them alone and unaided but finally gave up the attempt, and hired a broker. I shall have to go in again some day next week so as to arrange about paying as my goods must be apprised and I shall have to sign some paper. I think no custom house in the world can compare with ours for the science of not doing things. This evening when I came back, about 8-30 I went to the laboratory and found Mr. E- hard at work. He told me

what he had been doing since I went away, and wanted me to criticise.

The light does not yet shine as bright as I wish it might but I am not dispairing at all but that success will come sometime in the future. Whether it comes or not I am learning a great deal and nothing will be likely to take that from me. The company that are behind Mr. E— mean to stay there for a long time to come and give him every chance to make a success. I feel very sorry about Kittie's death, it must be very hard for Aunt Susan as she was so pleasant a child. Mother said tomorrow is your birthday and I send you by this all greetings and good wishes, as

Your loving Son

Francis R. Upton

E-6124-4.

Menlo Park, March 2, 1879.

Dear Father!

My goods are part of them in the depot here, but as one package went astray I could not get any of them. I expect it will turn up tomorrow as it probably was carried beyond. I am you may be sure anxious to see how my goods and possessions look. Lizzie said in her last letter that she expected to return the last part of July or the first of August, and she says she will be willing to be married then. I feel that I am able to take care of myself, trusting to the future. I find my work very pleasant here and not much different from the times when I was a student.

the strangest thing to me is the $12 that I get each Saturday, for my labor does not seem like work but like study and I enjoy it. The electric light I think will come in time and then be a success, how long that time will be is quite a question. I think that it will be successful eventually, and then my place will be secure. I learn much every week and soon, that is in a year or two think I will be an expert in electrical questions. My pay I know is very small in dollars but the chance to get knowledge is beyond measure.

I hope to earn some money indirectly by writing, and also make my name better known.

I am with very much love
Your Son
Francis R. Upton.

E-6124-5

Menlo Park. (1879)
March 23, 1878

Dear Father:

I felt sorry to hear of George's trouble, but was not astonished as I could not well see how he could get on always as his affairs were. I think it much better that the anxiety should be over with and a new start made. You have always said that George could only learn by hard knocks, and I think he has had a lesson.

I had a talk with Mr. Edison about wages and the future. He does not offer

me any higher wages, but makes me to a certain extent a sharer in any success he may have. He has promised me to give me the copyright of any work he may publish on the Electric light. In doing this I am thus to have the editorship of the work, and to pay for the expense of getting up the drawings. I shall also have the proceeds of any article he may write. He does not like the trouble of writing and yet is willing that another should dress his thoughts for the press. You may smile at the prospect and think that promises will never buy bread and lodging, yet there is a certain degree of hope in such conditions. The electric light has been on exhibition during the past few days. It shows a fair promise of being ultimately a success, and of course then giving me all the money I may need. He has lit up his shop with 18 small lights made from platinum. Each light was about equal to a gas burner. I am fully satisfied with my prospects even if the light does not succeed for I shall have no trouble getting a job somewhere else on Edison's recommendation.

Lizzie writes me last from Gibralter, she says that she has enjoyed her journey through Spain very much. When she wrote she had just returned from a donkey ride to the

fortress. I was astonished when I saw the stamp, a two and half penny English, for I did not know but that something was wrong and they were on the way home.

I expect to go home in four or six weeks and spend a few days. I want to ask the united wisdom of the family to advise me how. I had better get married, and what sort of place I had better have after marriage.

I am with much love

Your Son

Francis R. Upton.

E-6134-6

Menlo Park. March 30. 1879.

Dear Father: -

The prospects here are about the same as they have been for many weeks, Mr. Edison has arranged during the past week or two to show his light as he has it now. It has ~~so~~ made a very good impression on those who are chiefly interested in its success. There is no doubt but that he can have money enough to carry on his experiments if he needs more, from many sources.

I know so many troubles ahead since I see how the lamp works experimentally that I do not ex-

fect as much for a long time to come.

I am perfectly contented as matters are now, I keep making progress in my profession and aquainting myself more and more with the science of electricity. There is no need of taking any thought or worrying as to the future since I cannot alter it. I have made up my mind to stay here as long as I can and take my chances at whatever may turn up. I know I can make a living in various ways, so I feel that my future is in good enough hands if I leave it to itself without much thought.

Charles wrote me last week about George's affairs, I wish you would ask Mother to give me an account of how matters stand when the accounts and statements have been made out. I should think you might feel relieved that what you have dreaded for so long is over with.

Lizzie writes me often telling how much she enjoys her travels in Spain. Everything she sees is so strange and full of interest. She has seen the Alhambra and seems to be somewhat wild over the many wonderful charms it possessed.

They are now I expect in Italy as in her last letter she spoke of turning away from Spain. I think her trip will have one good effect

that it will wean her to
a large extent from Bruns-
wick and make it easier
for her to settle elsewhere.
If we marry this summer
as is now the arrangement she
may have the same feeling
that I have in settling, that
she is coming to a home.
I have not made any in-
quiries as yet respecting a
house but think I can get
one. There is as I have said
a large one near the labora-
tory which I think $450 will
hire and that is the only
one here that is what I want.
I will tell you all when
I come home which I expect
to do in about three or four
weeks. With much love
I am Your Son Francis R. Upton.

E-6124-7

1879

Menlo Park April 4

Dear Father:

The day I left home I kept very busy, for in the morning I had two large fillings taken out and temporary fillings put in. During the day I saw four of my old college chums including Sargent who is now in the gymnasium at Harvard. He has a most elegant position with a fine salary. The building he is in cost $150,000 and is palatial in all its appointments. Dr. Goodall seemed

to be glad to see me and gave me much information.

I found a travelling companion when coming on in a college friend who shared my room with me. The cold I had grew much worse and for three days during the week my voice was in all keys and entirely out of control.

Profs. Brackett and Young were here yesterday and made a number of tests on the machine we are using which showed quite well.

The light is very slowly progressing, a little slower than I should wish

It is hard to make the lamps we want though we can make very good ones. We have placed our hopes very high for we can make lamps with a few hours life which are extremely economical and there seems to be no reason why we cannot make them last many hours in time.

I know the light is a commercial success as we have it but not in every case sufficiently so to make it take the place of gas.

With very much love I am

Your Son
Francis R. Upton.

E-6124-8

1879

Menlo Park Apr. 13

Dear Father:

I went into New York yesterday so as to spend Easter there. I tried this morning to get into Trinity church but could not succeed on account of the crowd, so I went to St. Pauls, the church next to the Astor House. The singing there was very good and the church worth seeing, as it is very old-fashioned and has been kept in the old style. It so resembled a German church that I felt to a degree carried back to my last year.

I have concluded that my last year was spent in the best way I could have possibly spent it. I find that I can talk with any of the German workmen here and have them understand what I say, and what is more understand what they say. I also have plenty to do in reading German and translating letters and odds. During the past week we have tried a new ~~magnets~~ machine and found ~~that~~ it was a great success. I can still report progress which is all we ~~wants~~ want.

Monday. I was so sleepy last night that I could not see the lines so I broke off short

You may have read in the papers an account of the failure here and perhaps seen the remarks that Mr. Edison made respecting the story. I cannot say that we are as yet successful, still there is much hope that we will make a commercial success even although we do not make the grand success we are looking towards.

Lizzie is now I suppose in Rome, the last letter I had from her was mailed from Pisa. She writes that she enjoys her trip immensely and I think it is a good thing for her that she can do so.

She speaks in each letter of being married and keeping house. I am going to

enquire about a house
before going home and see
what chance their is.

I must go to my work,
so with much love
I am Your Son
Francis R. Upton.

E-6124-9

1877

Menlo Park April 22

Dear Father:

Sunday night I read so late and was so tired that I did not write you. Today is the first real spring day warm and pleasant. It makes outdoors seem very attractive. As soon as the leaves are out I shall take a few days vacation and go home. As long as I can have a choise of seasons, there is no reason why I should not take the pleasantest.

Lizzie writes me from Naples

and that she is enjoying her travels very much in-deed. She says Mrs. Perry had two handkercheifs stoled from her pocket in one walk, and that she could not imagine how it was done. I expect they are in Rome now as such was there plan.

I am enjoying myself ~~as~~ as much as I can expect to, learning something new each day. I am busy now with measuring currents, using two instruments that have just been made after my drawings. You see I have a chance to learn how to make instruments, and see them made. I shall be an expert on dynamo-electrical machines in the course of a short time for I see so many various trials of different devices. Nearly each week there is a new experiment to be tried.

I have got my name in a book publisher's life of Mr. Edison as an able mathematician. So you see I am getting on in the world.

I thank Edgar for his letter and will try and answer it soon.

I am with much love
Your Son
Francis R. Upton

E-6124-10

Menlo Park. April 27 1879.

Dear Father:

This month is nearly through and I hardly know where the time has gone, though I have learned and done quite an amount. Mr. was sick during the past week for three days and during that time I had a fine chance to experiment to my satisfaction. One thing is quite noticeable here that the work is only a few days behind Mr. Edison, for when he was sick the shop was shut evenings as the work was wanting to keep the men busy. I had a note from Louisa saying that she ~~expected~~ ~~would~~ like to make me a visit, I expected her here yesterday but she did not come.

There still is hope that this summer will see a public exhibition of the electric light. There are thousands of difficulties to be overcome yet before it can be given to the public and Mr. Edison will overcome them if any does. I have not in the least lost my faith in him for I see how wonderful the powers he has, are for invention. He holds himself ready to make anything that he may be asked to make if it is not against any law of nature. He says he will either have what he wants or prove it impossible. If he does not have a lamp to use electricity he will show that with present knowledge it cannot be had.

I hope to go home for a visit in about ~~the~~ three weeks, and hope to find the family health good.

I am with much love

Your Son

Francis R. Upton.

E-6124-11

Menlo Park, May 24, 1879.

Dear Father:

I went to Lawrence as I expected and found Mr. Fallon ready to give me any information that I might wish. He also said that he would answer any questions that I should ~~answer~~ ask by letter, which I thought would be the best way of getting information. I could not get to Lowell as I expected on account of the trains, and have sufficient time. Yet as I could find from Mr. Fallon all I wanted it made but little difference

whether I went or not.
Mr. Edison seemed pleased to see me back and glad of the information I brought with me. In the afternoon he and I had a long talk about matters pertaining to the light. The telephone system has been progressing since I left, and a large amount of work had been done.
The machine for lighting the North pole had been sent away and a large number of carbons had been prepared for the purpose.
Mr. Fallon seemed to think that the electric light might be made in time to take the place of gas in mills. He said that the gas they used cost nearly as much as the water.
I went to lunch with him, and saw his place he is very deep in gardening.
I judge from certain indications that Edison hauled in some money last week from his telephone contract in England, as he has just ordered about 500 books, and my landlady said given $1000 to his wife. He seemed to be in good spirits which looked as if he had some money in the bank, for he was dead broke when I left, for I heard him say so, and knew he had trouble to pay his pay-roll as he had over drawn his account.
There is still a mint

of money in telephones yet. I should like very much to have a share of it. Yet if the Electric light succeeds there is far more money in it and I feel sure that I shall have a share in that.

There is the same artist here now painting a picture of Mr. Edison that there was in Brunswick to fill the panels in the chapel. He comes from Scribner's Monthly to give them a head from which to engrave a portrait.

With much love

I am

Your Son

Francis R. Upton

E-6124-12

Menlo Park June 1, 1879.

Dear Father:

This week has not been very eventful to me. I have fallen in with my regular work once more, and the time will go rapidly. There is nothing like interesting work for hurrying away the weeks. I found on my return that quite an amount of work is done here in a week and that affairs go on at quite a rapid rate.

The electric light is at the present waiting for the London telephones to be put away. There is a fine chance for a young man to gain a living. Mr. Edison is on the lookout for a man and cannot find one who suits, who will go. The salary is $6.000 a year or perhaps more + a good business man who understands a little about electric-

ity, and who has a record of having managed something well, is what they require. There are very few who will leave this country for England to take charge of an enterprise which must be of necessity somewhat risky being entirely new and almost untried. I have found a place in the neighboring town, about a mile and a half away which if I can get at low enough figure will just suit me. The house is small but fully large enough, three rooms on a floor and an attic room. Its great recommendation is that its is furnished with a furnace, hot and cold water in a bath-room, and has a gas machine. The place is very complete and cost $5700, I am told, to build only last year. I can probably rent it for the interest on a mortgage of $4.000 (?) I shall find out definitely regarding it before next Sunday. Lizzie at last accounts was in Interlaken. She says July 28 or Aug. 5 will be the date for sailing.

With much love I am Your Son
Francis R. Upton

E-6124-13

Menlo Park, June 15, 1879.

Dear Father;

I have not found any house as yet which suits me, I had one in view which was exactly what I wanted, but no title can be given either to rent or to sell. I shall go to a neighboring town and keep a horse as there seems to be no chance here of finding a house. I had a talk with Mr. Edison today regarding my future. He seems to think favorably of giving me a share in the business instead of wages. The only trouble is that I may have to wait a long time before the profits come. yet if they are nearly as large as the telephone profits. I may consider my-

self in great luck. He sold the other week ~~£80 shares~~ the right to one of eight districts in London for $25.000 and will probably sell the rest in the course of a few weeks, as last week he found out how to make his new telephone a complete success. The royalty is to paid in addition to this first payment.

I think it would be quite a fine thing if I could come into partnership, if I only had a little more capital to live on until returns appear. Do you not think I have done well to be able to talk of ten per cent of the total profits at the end of six months, and to have my proposition considered as it is now?

Much love

Your Son

Francis R. Upton.

E-6124-14 79

Menlo Park June 22.

Dear Father!

I have broken my usual rule today, for I have been working nearly all this Sunday. Mr. Edison has been very hard at work on his new telephone receiver during the past week, and has succeeded in getting it into very good order. He has been working night and day and I have been up two nights and parts of four. He sees about $100,000 in cash to come to him from England if he gets it to work satisfactorily. He has 2/3 of this clear after

he has paid such shares as he had given away.

I had a talk with him this afternoon and he spoke of five per cent on the electric light, he did not make me a direct offer but hinted that I might have so much. He said that he would give it me the same as he gave to Mr. Batchelor only half the amount he gets. It will be five per cent of the profits, yet I shall have no papers except that my name will be placed on the agreement he has entered into with the electric light Co. I take no risk beyond losing my time for a year or two for it is not a partnership, Mr. Edison runs all risk puts in all the money and gives me five per cent on all his sales clear. There is about $100,000 worth of property here and some twenty to thirty men employed so I think five per cent on the total product is a fair show. I think with some pertinacity I could get him to make is seven and a half, for he is very easy in such matters, yet as it is pure generosity on his part I think it is not becoming in me to try and jew him. Besides if I grumble perhaps he may say no.

This is what I come in for, fifty shares of Electric light

stock, worth today over $100, free from assessment. This comes to me immediately but of course not for me to sell. Then when the Electric light is accepted $5.000 in cash and $1500 a year for 17 years, so why should I find any fault with my chances. I am going to say yes, I will take five per cent, would not you? The only trouble in the arrangements is that the light is not yet out and far from perfection, yet as I am only getting $600 a year I do not lose much if I go two years without pay. I do not say I can get five per cent, yet things look that way. I am with much love Your Son

Francis R. Upton

E-6124-38

Menlo Park, June 27, 1879

Dear ~~Sister~~

Your last letter was written so plainly, that I easily made out that I had made a blunder in not endorsing the check I sent you. I enclose it now for you to endorse. Perhaps you wrote so plainly that I might read that you that you wanted a pin, which considering that it is you, you may buy and give the balance to ~~my~~ Aunt Robbins for the contribution box as it will hardly be worth while to put in the Bank. Give my love to Bessie, I am glad that she is better, I did not realize that she was so sick

I did not find a word spelled wrong in your letter.

I think you planned out a busy week, hope you did all you intended to.

I am with very much love Your Brother

Francis R. Upton.

FROM THE LABORATORY OF
T. A. EDISON,
MENLO PARK, N. J.
U. S. A.

E-6124-38A

Miss. Sarah F. Upton
Peabody
Mass

MENLO PARK
JUN
28
N.J.

E-6124-15

Menlo Park, June 29, 1879.

Dear Father;

I do not understand why you should object to my taking the share I thought of taking in the Electric Light. I have not had a good chance to talk alone with Mr. Edison during the past week so have not said anything more about the matter. I only risk my pay if I accept his terms to take a share, for he will only put my my name on the agreements he has with the Electric Light Co. and give me some shares of the stock. The market value of the stock will be more than my salary for eight years and the light will be a success or failure long before that time. If I take the share, it is only in the profits which will be very large in case of success, $30.000 a year garanteed royalty.

Then Mr. Edison will have probably

over a $100,000 advance royalty from his English patents coming to him in the course of a few weeks, and this sum will be largely expended in building here, which will be used for experimenting on the light. During the last two weeks he has perfected his new receiver so that it is a most valuable instrument. 5% on that would bring $5.000 in one payment for England.

He was unfortunate in selling his rights in America at a low figure to the Western Union, he only gets $7.000 a year for his telephone patent which is worth ten times that.

I had a letter from Lizzie dated Berlin June 11, the day of the Emperors golden wedding. She was stopping with the same family where Curt and I roomed during our stay.

I am with much love

Your Son

Francis R. Upton.

E-6124-11

Menlo Park July 6, 1879.

Dear Father:

I have entered into the agreement I spoke of with Mr. Edison to have 5% of the profits from the light, and 5% of the stock he now holds in the electric light. I thought that so long as my pay and position would depend on the success of the light I might as well run a somewhat greater looking risk. As the matter is now the next time Mr. Edison goes to New York he will have transferred to my name 37 shares of Electric Light stock which has sold as high as $200 a share during the winter, as it is preferred stock free from assessments. You see I was placed in rather a peculiar position to drive a bargain. I had made up my mind to stay, ~~or~~ even if I could get no more pay or prospects, for a year or more, for the ~~sake~~ of the Training

I get. So how could I make him Mr. Edison give me fifty shares instead of 37, though perhaps I might have done so by ~~not~~ sufficient argument. Yet as the offer came from him there did not seem much chance for argument. There is in my mind a good show for electric lighting now, and if it can be made to do what we hope to make it do, there is an enormous amount of money in it. We have now the best generator of electricity ever made and this in itself will make a business.

I hope the sick ones are better

I am with much love

Your Son

Francis R. Upton.

X-E 6285-5
1879-07-11

Menlo Park July 11 1879.

Dear Charles.

I have entered into a new arrangement with Mr. Edison as you may know. I thought it as well to take a share in the light, although it may never bring me anything. ~~Its~~ My reasons were largely these. I knew that if I could get an interest my place here would be far pleasanter, for I should be free to do as I like. Since I changed my agreement I notice Mr. Edison takes it for granted, that I can direct my own and other's work, ~~far~~ much more than when I was working for fixed wages.

Another reason was that if the light does not succeed, I shall have the run of the place here for experimenting if ever I may want ~~to~~ it, and stand a much bet-~~ke~~ter chance of getting any positions that may be offered in which Mr. Edison is interested. This is prospective, actually

we have another now a machine for generating currents that is bound to come into great use for transmitting power and for plating. I admit that my reasons were largely personal, that I would rather lose a years wages, in order to run the risk of gaining a large amount in company with a man like Edison. Just think a moment of the amount that a year will decide one way or the other $5.000 in cash and $1,500 a year for 17 years and nothing to do except to draw it. Then I know that the electric light can be in all probability be made to work if sufficient time and money are expended, for there is nothing in the nature of things against it, and all theory is in its favor. We have not as yet what we want, but we have as good if not better than any one else in the world. The natural result of my change of base is that I must draw on my money at home. I wish you would send me a check for $50 drawing the money from the bank.

I do not feel that I have made a mistake for I have great hopes of ultimate success, and success that is far beyond the dreams of experimenters of the past, for light in itself does not cost anything scarcely, it is the enormous amount of heat that by known proceesses goes with it that costs.

With love to your family I am Your Brother Francis R. Upton

T. A. EDISON,
Menlo Park, N. J.

July, 1879
F R Upton
to "his Brother"

X-E6285-5

Chas. B. Farley Esq
Peabody
Mass

MENLO PARK AUG 11 N.J.

FROM THE LABORATORY OF
T. A. EDISON,
MENLO PARK, N. J.
U. S. A.

E-6124-17

Menlo Park. July 13, 1879.

Dear Father;

Today I have taken a walk and sleep, as is my custom on Sunday, when Mr. Edison does not drive the work on to me, During the coming week I am going to work on a new job for me. I am going to make some scrap books out of some files of journals, relating to electricity. I became disgusted at seeing the pile of papers waiting for some one to attack them, and so I offered to do my share. I think that Mr. Edison will go back to the Electric Light in full force about two, or three weeks from now. Until then I work on my own account, testing and figuring, and now cutting up paper. I have two boys to help me in making the scrap-books, so I think

that I shall get through the four years of accumulated journals this week. I feel very well contented with my new arrangement, for it makes as good as any one here. I now have a say to a certain extent. There will be a great deal more money expended here and I have but small doubts of our ultimate success, and then three cheers. I am looking forward to Lizzie's coming with much joyful anticipation as you may think. I shall go to New York the first of August, to meet her and shall stay over Sunday. If the boat does not come then I shall take it for granted that it is delayed and return here. I cannot tell yet when we shall get married, that will depend entirely upon Lizzie.

I am with much love

Your Son

Francis R. Upton.

E-6124-18

Menlo Park July 21 1879

Dear Father;

I did not write you yesterday as I was very busy. I had a chance to write something for Scribner's. There has been a series of articles appearing in the magazine about Mr. Edison's inventions The series was written by a young newspaper man ~~on~~ from the New York Herald. He did not succeed in getting the ~~electrical~~ electrical part of his ~~sub~~ subject clearly into his head and so did not write as clearly as was wished. The editor brought the proof ~~of~~ here for Mr. Edison to read and with his consent gave it me to rewrite the electrical part. I hope I may make about $20 for my work, though no agreement was entered into regarding pay.

I am counting the days before I expect Lizzie. I shall go to

New York in order to try and be on the wharf when she arrives. I am going to give Sarah the charge of arranging what my part of whatever wedding Lizzie may want to have. I think she will enjoy it more than I.

Give my love to Bessie, I cannot realize that she has been so sick, it must have been hard for Edgar.

With much love

I am Your Son

Francis R. Upton.

E-6124-19

Menlo Park, July 27, 187~~8~~9.

Dear Father!

Yesterday Mr. Edison gave me a certificate for 36 shares in the electric light company made out in my name. The par value of the shares is $100 and the market price very irregular, during the winter it has varied from $150 to $200. Anyway I think it is a good start for building air castles. The electric light is far from being a failure and I consider my prospects good of $5.000 cash before another year has passed.

I am finding the time running very slowly just now, since I keep counting the days before I expect Lizzie to arrive. I expect she will be willing to marry me in the course of a few

weeks. I suppose you will want to make me a wedding present of such expenses Sarah may see fit to make in order that I may marry in a style that suits her taste. I give her the chance to take charge seeing no immediate prospect that she will have another equally good chance.

If you do not want to do this I shall let her draw through Charles on ~~the~~ my bank account, for I mean to be married in a proper manner so that others may have the satisfaction of thinking I am well married.

I am glad that the health bill, as reported by Maria, of the family is so good. It has been a sickly winter at home from all accounts.

I am with very much love

Your Son

Francis R. Upton.

E-6124-20

Menlo Park. Aug. 11, 1879.

Dear Father:

I should have gone home Saturday but just at the present I am very busy here with experimenting. Mr. Edison is giving all his attention to the electric light and finding out a great deal new about it. I feel anxious to be on the spot so that I can see why the various contrivances are changed. Besides this we intend to make a series of tests regarding the transmission of power, and these will be entirely under my charge, as it is nearly all calculation which is needed. I think I have found a law, but I have yet to test it before I can with certainty say whether it holds in all cases. Mr. Sutro of the Sutro Tunnel has written to Mr. Edison regarding transmitting power

power to the mines in Virginia City. He say there is a river power of 3000 or 4000. horse power only four or five miles away and that he thinks this could be utilized. They now burn wood at the mines and it costs $10 or $12 a cord. Mr. Edison thinks that the power from Lake Tahoe could be utilized, it is only 20 or 25 miles away and power can be taken that far by means of electricity. I feel very confident that it can be done. This will be a chance for me in case the E— L— plays out. I expect to get married in about five weeks, and I am going to come home for arrangements in a week or two. You may expect some hints for a wedding present in the ~~sha~~ shape of the wedding garments. Much love

Your Son

Francis R. Upton.

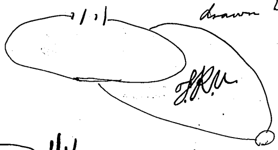
E-6124-21

Menlo Park Aug. 12, 1879.

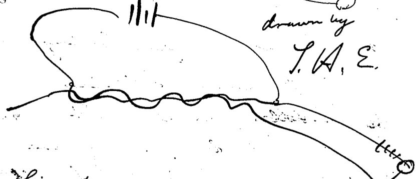
Dear Mother;

I am thinking of going home Friday night will reach Peabody Saturday ~~morning~~ about 10-30 ~~in the middle~~, as I want to go to the tailors and leave my measure. I shall go to Brunswick in the afternoon to finish arrangements for my wedding, and come back here Monday night. I should like to make a stop at home but do not see how it is possible as I cannot leave here at the present, and I shall want to take a few days the next time I leave for a wedding and a short trip before buying the furniture for a house. You remember the promise you made about the Hopkinton furniture I shall keep you to it, if it was a promise for it will help me -

I could not find another sketch



drawn by F.R.U.



drawn by T.A.E.

mensity. Lizzie wants to buy every-thing to last and not so much in quantity. Time hangs on my hands when I think of the prospect that is promised me. With love

Your Son

Francis R. Upton.

E-6124-22

Menlo Park, Aug. 24, 1879.

Dear Father:

This week Tuesday I am going to Saratoga to the American Association for the advancement of Science. Prof. Barker who is president of the association for this year was here the other evening and invited me to read a paper on the tests I have made on the new machine of Mr. Edison's, which I am going to do. I shall go in company with Messrs Edison and ~~Bathe~~ Batchelor taking the steamer Tuesday night up the Hudson. This will be a fine chance for me to see the various scientific men of the country. I had a fine sail by day light through the Sound and arrived in New York about two of the afternoon after I

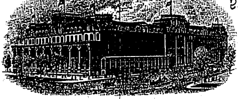
started. I went up on top of the paddle box as the boat came into the harbor of New York. and had a grand view of New York. I found the work as I left it, as Edison had been to New York while I was away to introduce his new telephone.

Tomorrow I make a set of tests to publish before the Saratoga meeting. I have just had the pleasure of seeing my name ~~ta~~ a communication to an English Engineering ~~J~~ journal critising an Englishman's test of an electrical machine, and reading his answer to the same. If I had a copy of the paper I would send it to you, getting a little reputation you see

Your Son

Francis R. Upton.

E-6124-23
23



UNITED STATES HOTEL
TOMPKINS, GAGE & CO. PROPRIETORS.

H. Tompkins.
W. B. Gage.

J. L. Perry.
L. H. Janvrin.

Saratoga Springs, N.Y. Aug 31 1879

Dear Father;

I have been here since last Wednesday and shall stay until tomorrow evening. Mr. Edison has gone and left me to read his paper which you probably find in full in the Boston papers for Tuesday, as well as a few lines giving the summary of my paper. I have enjoyed my stay here very much and have made quite a number of pleasant acquaintances and an insight into the

methods of carrying on such a meeting. The only drawback is the money it costs, but I think I am well repaid. I get half rates here at the hotel in common with other members of the association.

I wish you would ask Saml to order me a pair of light walking shoes, heavy enough though for damp weather. My measure is at Buswells.

I cannot realize how short the time is before I shall become a married man. You may be sure I look forward with much pleasure to the prospect. I wish Lizzie could have been here during the past week for she would have made so many acquaintances.

Your Son with much love

Francis R. Upton.

E-6124-24

1879.

Menlo Park Sept. 7.

Dear Father:—

I think I shall go home Thursday night so that you may expect me Friday morning. I want the time to bring all my goods together ready to send out here. I find the time hangs very heavily on my hands when I think of what a change is to take place in my whole life. I only wish I had a sure income, large enough to meet all requirements, but I feel satisfied with my prospects now, so that I can draw on my principle with ~~[illegible]~~ so less uneasiness.

I find everything pleasant here, and the being master of my own time makes it much easier. I can come and go when I like for I am interested in the concern and Edison takes it that I should know what is best.

I am with much love

Your Son

Francis R. Upton.

E-6124-25

Menlo Park Oct. 19. 1879.

Dear Father

I am now fully settled. My piano came Friday and is a very fine one the tone is full and rich, and its appearance very fine. It fills the corner of our parlor very well and is a great ornament. Today I had one of the young men from the laboratory come to dinner and he played very finely two or three pieces on it

to christen it.

Mr. Edison's telephone contracts in England are about closed, I believe all but the ready money. His share will be about $215.000 cash for advance royalty which will leave him after he has paid all claims about $175.000 to put in the bank to his credit. I hope he may get it in the course of a few weeks so that flush times may shine on Menlo Park. There will be a new chemical laboratory the moment the check comes. Mr. Edison has set his heart on having as fine a one as there is in the world for practical purposes. He may give me a small slice, I shall ask for it anyway.

The electric light goes on very slowly, I hope towards ultimate perfection. If we can get what we want the money will come in enormous amounts. There is scarcely an invention in the world which has such promise of large amounts of money. Yet if does not succeed I shall be contented with the expreince I shall have, though of course very much disappointed at not having the money.

Lizzie is becoming a

a first class cook and house keeper. She is a worker, and keeps busy the whole day long and accomplishes a great deal. She has not had any callers as yet but expects them every afternoon. Calling does not seem to be much the custom here, no more so than in Peabody.

With much love from Lizzie and myself

I am Your Son

Francis R. Upton.

E-6124-26

26

Menlo Park Oct. 26

Dear Father;

This week has brought nothing very new. The electric light is looking up, for we have had some very good lamps. The latest gossip that Mr. Edison has told me, is that there is talk of swallowing the old Electric Light Co. in a new one and making the capital three millions of dollars.

This new company will be floated by Drexal Morgan & Co. of New York. There is no hope of such a thing until Mr. Edison has given an exhibition. So he is going to try and show some lamps here in the course of a few weeks. I think I shall have some of them in my new house. Our parlor looks splendidly. the piano you gave us helps immensely ~~to furnish it~~ and fills up the corner of the room very well.

The pictures we took from home are quite handsome on our walls, there being no others to put them in the shade, as at home.

Lizzie seems to be quite well contented here and I think will grow to like her new home very much as all about it is so pleasant.

The telephone ~~money~~ money from England will come in next month, I am going to try for a small bite.

Your loving Son
Francis R Upton.

E-6124-27

Menlo Park Nov. 2, 1879.

Dear Father:

The electric light is coming up. We have had a fine burner made of a piece of carbonized thread which gave a light of two or three gas jets. Mr. Edison now proposes to give an exhibition of some lamps in actual operation. There is talk if he can show a number of lamps of organizing a large company with three or five millions capital to push the matter through. I have been offered

$1.000 for five shares of my stock making at that rate what Edison gave me worth about $7.400, a good years pay I think. Edison says the stock is worth a thousand dollars a share or more, yet he is always sanguine and his valuations are on his hopes more than on his realities.

I am going to New York tomorrow early, to ~~see~~ buy a few books and to go with Lizzie to see if we can get a girl.

Your affte Son

Francis R. Upton.

E-6123-28

28

Menlo Park Nov. 9, 1879.

Dear Father:

The excitement during the last week has been purely local for Lizzie and I for we have found a girl and prepared to send away Maggie. We found some Swedish emigrants and from among them we picked out two, a middle aged woman and a young girl. Lizzie is finding a good deal of company in teaching

them the names of the various articles that are used about the house.

We hope that they will stay for it is so hard to get any one to stay here, and Lizzie wants to be sure of having some-one that will stay, for a pair of helping hands ~~a~~ in a house the size of our is very needful.

I had a letter I wrote come out in the last number of the Scientific American replying to a communication criticising Mr. Edison's machine for generating strong currents of electricity. In the number after the next there will be still another letter examining another man statements regarding Edison's machine.

The Electric light seems to be a continual trouble for as yet we cannot make what we want and see the untold millions roll in upon Menlo Park that my ~~dreams~~ hopes want to see.

It is extremely warm here for this season and everything is dried up for want of rain

Your loving Son
Francis R. Upton

E-61[illegible]-79

29

Menlo Park Nov 16.

Dear Father;

Maria & Charles have been spending today with us and we have enjoyed their being here very much.

Just at the present I am very much elated at the prospects of the Electric Light. During the past week Mr. Edison has succeeded in obtaining the first lamp that answers the purpose we have wished it for. It is cheap much more so than we ever hoped to have

The light is obtained from a a piece of charred paper which is bent thus

The ~~piece~~ burner is ~~a~~ made from common card board and cut to about the size shown. This is then sealed in a glass bulb and the air exhausted and then a current of electricity passed through it which heats it to brilliant whiteness so that it will give a light equal to that from a good sized gas burner. The making of such a burner has made the stock of the Electric Light Co. advance in value, $400 has been offered for shares and there are no ~~takers~~ sellers. The last week has made all my prospects very bright, and I hope they will continue so. I expect that there will be an exhibition given in the course of a few weeks. The wire are laid to my house and I shall light up my parlor. If you wanted to show one or two of your pictures you could lend them to me and I would hang them in the best place in my parlor. Ahem!

As matters are turning out I am glad over and over again that I did not spend the year in Germany for I now am put in the way of getting a living far beyond what I then dreamed was possible. I am a thorough master of all that is concerned so far in making a good light. We think as far as price is concerned that we can sell it so as to compete with gas at 50 cts a thousand feet.

Very much love
Your Affectionate Son
Francis R. Upton.

F-6179-30

30

Menlo Park Nov. 22

Dear Father:

The Electric light is slowly advancing from the last big step. We now know we have something and that is what we have not know until last week. We can compete with gas in a great many ways now though not as completely as we wish, yet there seems to be nothing to prevent our getting a perfect burner that shall do as well as gas. Time and cost will prove what we have

to be good or bad.

Lizzie is getting on somewhat better with her Swedes and thinks she will give them a longer trial rather than to have the bother of new help. They do the work during the week though they are very slow in getting about.

I am busy now preparing an article on the Electric Light for Scribner's Monthly to come out in the Feb. ~~N~~ number I hope it will bring me $50 or $60 and some fame. You see my work has been very closely connected with Edison's and if the electric light succeeds ~~its~~ in all that we hope of it, it will bring me a good name. If it after ~~caf~~ careful trial proves much cheaper than gas it will probably bring me a large salary. Dollars and cents are ~~or~~ now the question, we have a light what we want to know is how much will it cost, and that is hard to decide.

Your loving Son
Francis R. Upton.

Menlo Park Nov. 30, 1879.

Dear Father:

My thanks giving day went off splendid-ly, the dinner was good and my company seemed satisfied. Mrs. Perry, John and Rob. came on and made the company with Sarah, the first celebration in my house. Howard Butler spent the night before thanksgiving with me and seemed to be very much surprised at finding me so well situated, he seemed to think that I would be in two rooms or in some very small house and

in a very modest manner. He told me the good news that the stock I bought in the Gold & Stock Tel. Co. will pay a larger dividend since the compromise with the Bell Co. and that what I bought at $16 is now $30 or $5. above par $25, so you see my first investment has turned out well.

The Electric Light has taken a turn upward during the week and now it really looks as if I had drawn a big prize. I have 37 shares of the stock and during the last week I have heard of two shares selling for $650 each or $24,050 for the amount I hold. I do not say I could sell my shares for that, ~~but~~ or that I have any thought of selling them, yet if I were an outsider I could get a price like this. Any way the stock is very valuable and makes at the lowest rates it is sold a good years pay. I cannot help laughing when I think how timid you were at home about my giving up $600 a year and now I have made at least $10000. Mr. Edison is going to give me five per cent in England and the continent of what he receives.

Last evening one of the gentlemen interested in the continental company hinted to me that he would want me to go to Paris for a few weeks this winter to help introduse the light there. I shall strike for high wages, I know I can stay with Mr. Edison. and learn much more than I should by going, yet money would be a great objelt and I am going to try for large pay, for I shall never have such a chanse again in my life

With very much love
I am Your Son
Francis R. Upton

[illegible] to parents

E-6124-32

32

Menlo Park Dec. 7.

Dear Father:

Yesterday I was busy all day writing my article for Scribner's ~~month~~ Monthly, it is against my rule to work Sunday but the work seemed to be thrust upon me.

The light is still prosperous I have had six burners in my house during the past week and illuminated my parlor for the benifit of ~~a~~ party of visitors from New York. The ex hibition was a success, Mr. Edison's and my house were the

only ones illuminated.

I brought the the light first light out of the laboratory to show Mrs. Perry how good a light we had, which could be of use in a private house. She was very much pleased with it.

There will be a great sensation when the light is made known to the world for it does so much more than anyone expects can be done.

Though there is no ready money as yet still I feel that I have done remarkably well even if I should leave at this moment and go elsewhere. When I think of my five per cent of England and the Continent if he holds to his agreement.

I do not know as I can go home at Christmas time, but shall try to get off for a few days. Then I will tell you all about the electric light.

Your loving Son

Francis R. Upton.

Prof Trowbridge
Dec 16, 1879

X-E62-98
1879-12-16

Harvard University
Cambridge

Dear Sir, Dec 16 1879

The armature of the Siemens machine wh. I used has 8 divisions & the commutator is divided to ~~correspondingly~~ correspond. A wire is attached to one section of commutator, then wound lengthwise the armature in one division until half full, armature turned 1/8 th. rev. wire attached to next section of commutator, and the division of armature then presenting wound half full as before. This is continued until armature is full. It is plain that while pieces of ~~one~~ wire may be used, practically one wire is taken which has 8 connections to commutator.

2. The current flows as in the Gramme.

3. Brushes.

4. Think not- believe that connections remain in same state as when machine was bought

The Siemens machine is described in Holcomb's patent taken out in 1876-

I believe I have answered your questions categorically -

If I can be of any assistance I shall be always happy to aid you - Very sincerely.

John Trowbridge

Menlo Park Dec. 21.

Dear Father:

Today has been quite exciting here since this mornings Herald contained an account of the discovery of the lamp and the whole invention. Mr. Edison had allowed a Herald reporter to take full notes so as to prepare his account for the exhibition which was to come off in a few weeks. The reporter was Edison's friend and he thought he could keep a secret. Yet newspaper traditions were too strong

and he sold out at a good prise I suppose for he had the first full account. Mr. Edison is very much provoked and is working off his ~~our~~ surplus energy today. The light is being fine and promises much money, yet all is promise.

I have my parlor lighted very beautifully with it. Lizzie has fixed the lamps with ribbons and flowers and I think I am a peg ahead of any one in the show, for all the other lamps are to be put in gas fixtures and follow old customs. Edison thinks people will like the gas fixtures best as they can thus better compare the lights given.

Lizzie is going to leave here Tuesday morning and New York 11 A.M. She will spend the night with you and go on the next day to Brunswick.

I hardly think I shall go home as this is the chanse of my life. I honestly think Mr. Edison has struck a great thing in the light as we have it here today.

Very much love

Your Son

Francis R. Upston.

E-6127-3

34

Menlo Park Dec. 28, 1879.

Dear Father:

The electric light is way up. Stock was sold yesterday for \$3.500 a share. It is an enormous price for a share the par value of which is only \$100. I have today received \$501 for the refusal of five share at \$5,000 a share, the refusal to last for one week. I hope I may sell at that price for then I could hold on to the remainder of my shares with great com-

port. I telegraphed for Edgar to bring on my certificate and I will show him what there is here for a chance. He probably can reserve no pay at first but if he wants a change can find it.

Mr. Edison has simply found one of the finest things of the age how to get a good pure light cheaply. It is all real here now, I have measured and tested again and again and find that we are doing marvelous things. I did not expect so much though I knew that there was every show of doing well.

Last night we had an exhibition and several million dollars of capital ~~was~~ were represented. Every went off splendidly. We had over forty two gas jet burners running from one machine. I had a number of gentlemen in my parlor among them the correspondent of the London Times. He made a note of my chandelier, as which Lizzie will tell you of, so that I may soon read of her decorations ~~tt~~ in the foreign

papers.

I wish so much I could go home and then I would tell you all about what we are doing.

Your loving Son
Francis R. Upton.

X-E62 98
1879-12-29

John K. Porter.
Grosvenor P. Lowrey.
Geo. Wales Soren.
Chas. Francis Stone.
Geo. S. Hamlin.

P. O. Box 1836.

Porter, Lowrey, Soren & Stone.
Attorneys & Counsellors at Law.
No. 3 Broad St. New York

Decem 29 1879

Dear Mr Upton.

Let me suggest a point or two about your article for Scribner. Whatever you say, and especially put in permanent form in print and give to the public, will probably be referred to and scrutinized over and over again, in the future, by rivals, enemies and critics, and when litigations come, by hostile lawyers and experts; and if the chance is opened you will certainly be "brought to book" on your article.

Between ourselves and confidentially, let me tell you that in our recent gutta percha litigation Prescott was over and over again made by the opposing lawyers to explain or to account for now unwelcome statements which he had long ago published in his books; and in relation to the quadruplex, while his large book was going through the press lately, pages already printed were cancelled, and the new matter was only inserted after careful scrutiny by counsel on our side — So you will see how things may come back to "plague the inventor" —

I think it would be very expedient that nothing should be put in print, especially by one who stands in such relations

to Edison and to the invention as yourself, without the approval of the most skillful and careful Counsel whom the Company may choose to designate. — A popular article without details of the invention involved and especially without any statements as to dates of the invention or disclosure of any of such material of Mr Edison's case a patentee, might be not unsafe. But in my personal judgment very great caution should be observed in everything. If I had my way I would not allow half the publicity that has been given by Mr Edison. It is very unusual. However, it is not distinctly my affair and I only throw in this last remark in order to emphasize what I have already urged here, and which I admit I suggest as my own motion solely and perhaps out of the too much caution that is bred of my trade. When an opportunity offers, I will take Lowrey's and Dickerson's judgment on what I have said

Yours Sincerely

[illegible signature]

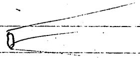
4250
12
8500
4250
51000

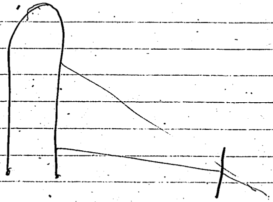
Investment

1

E 6285-7
(1879-12)

Boilers chimney	36.000	
12 Engines + Dynamos	51.000	
Foundation –	2.300	
12 Iron Structure	7.000	
Wood flooring &c	3.000	
Water Heater + pumps blowers Iron floor boiler supt	8.000	
Extra Electrical Appliances	2.000	
	~~94.300~~	109.300
Conductors	50000	50.000
	144,300	159.300





2

E-6285-7
(1879-17)

Depreciation

Boiler Chimney	10	3600
Engines	3	15.30
foundation	1	23
Iron Structure	2	1,40
Woodflooring	5	150
Water Heater pumps boiler floor	5	400
~~Boiler floor~~	~~2~~	~~$ 4343~~ 5843
Conductor 2 pc ~~Faradic Machine~~	~~3~~	~~1000~~
		~~5343~~

Ex Expenses
Labor

Depreciation per "M"	~~29~~	6.4 cts
~~Labor~~	~~13.2~~	

Labor	2 Engineers	8
	1 ~~Wiper~~	1.50
"	2 Firemen	4
	~~1 Laborer~~	~~1.50~~
	2 Laborers	3
	2, Regulators	4
		$19 per day

7.6 cts

Executive Expenses $11 daily. 4.4 cts

11
300
3300
30
99000

3

Dust Coal costing 2.75 with 4 lbs of Coal per Electrical horsepower ~~12.4~~ tons $33.

Coal $33. $250 / 30 / 280 13.2 cts

Water rate etc. $11. daily

Rent Insurance Taxes- $7,000 yearly

Summary

Depreciation	6.4
Labor	7.6
Coal	13.2
Water	4.4
Rent,	7.7
Ex Expenses	4.4
	43.7

Estimate
Cost Elec Light
" T. A. E.
About Dec 1879

FRANCIS R. UPTON COLLECTION

1880

Menlo Park Jan. 25, 1880.

Dear Charles:

If I had taken your advise I could have bought my electric light stock back at the present figure and had quite a sum in the bank. There is no trouble that I can see even now in the future. I have been figureing during the past week on some estimates and they all show that we are

going to make enormous profits at the present prices of gas, and fair profits at the present cost of gas. The lamps are durable as far as we can judge and no new troubles show themselves. I should say it is a good time to buy stock. There is no doubt of our going into New York in the course of six ~~month~~ months. The patents are going to be excessively strong. I inclose a check for $25 for you to refund what you paid out to Nat.

Your Brother
Francis R. Upton.

(80)

Menlo Park Jan. 25.

Dear Father:

The electric light is growing better constantly. I have now a light over my desk so that I am writing you this letter by the light from a little horse shoe.

There is now a burner in my bed room so that now I do not have to fumble after matches but simply to touch a plug

so as to procure a light to wash and dress by. Mr. Edison is going on with his plans for making a large factory here to make electric lamps. We have no doubt as to the ultimate success of ~~his~~ the success of electric lighting and of the great profits that will result from introducing it. The lamps are now lasting as long as can be expected for some have been burning since they were first made and are yet good

One lamp has burned 550 hours and a number are now approaching 500 hours and all those lamps are without the improvements that have been made during the past few weeks which will tend to make them far more durable.

The stock of the company is quoted far lower than when I was at home, but is bound to come up with a rush when the light is put into New York and we are manufacturing large numbers of lamps each day

If any one wanted to speculate just a little I should advise this as a chance. There is no trouble in my mind to selling the light at a large profit in many cases at a price below what gas can be made for. For special purposes where light is used for a large number of hours, 25 cts a thousand feet is about the estimated cost. Gas costs 45 to 65 cts in the holder

Your Loving Son
Francis R. Upton.

Proof Marks
March 4, 1880.

X-E6278
1880-03-04

Unvsty of Penna
Phila Mar 4 1880

My dear Sir

I regretted that our conversation was cut short by the limited time of my stay, and in order that we may not misunderstand each other, I send you the following figures.

The Engineer fireman or foreman of shop, I do not know them apart, remarked that 15 lbs of steam with cut off at ½ the stroke would run the engine, idle line of shafting and the 4 generators with the number of lights then on. (90 I believe.)

The conditions stated would give with sufficient approximation for practical purposes about 10.37 lbs mean pressure of steam in the

cylinder

Giving for the horse power of the Engine

$$\frac{10.37 \times 201. \times 7 \times 60}{33000} = 26.53$$

If we allow 5 H.P. for the idle line of shafting we have about 21 or 22 H.P. left for machines showing that each HP generated in the neighborhood of 4 lights

If I have been misinformed or am incorrect in my figures (approximate only) I should be pleased to be set right.

Did you note an error as regards the tension on the belts of the dynamometer described in the Feb. number of Scribners?

I am

Very Truly Yours

Wm D Marks

Mr Francis Upton
Menlo Park

X-E62-93
1880-03-09

Baltimore, March 9/80

Thomas Eddison Esq.

Dear Sir,

I have been waiting to receive your list of instruments, but it has not come. However, I will bring my own instruments as they are the only ones in the country whose ~~resistance~~ constants are known in absolute measure. I have thought of three ways of experimenting any or all of which we can choose. The first is by your dynamometer, which will give us the whole work done. The second is by the measurement of the resistance of the lamp and the quantity of electricity passing through it. The third is by putting the lamp in water and seeing how much heat is generated in the water. This last is probably the most accurate in a rough experiment, but I think we should try them all as a check on each other, provided

[2]

you can arrange for them. For the third experiment, all that is needed is a thin copper vessel, as small as will hold the lamp conveniently, and a lamp with insulated wires so that it can be immersed in the water.

For the second experiment, there should be a solid stool, about 2 ft. square fixed in the ground in some shed or other, out of the way of the machinery, so ~~that~~ my instrument can be set on it firmly.

[3]

Can you tell me what size of wire will not heat too much by the current to the lamp? Also high your resistance boxes run and what kind of a tangent galvanometer you have. Anticipating great pleasure from meeting you, I remain

Yours truly

H. A. Rowland.

Johns Hopkins University

Prof. Rowland
March 9, 1880.

[4]

E-6124-36

36

Menlo Park May 9

Dear Father

Today has been a regular hot summer day although a little ahead of time. The thermometer was 78° in my dining room. The season is well advanced here, the cherry blossoms have passed by and the apples are in some cases through. The foliage of the trees is now nearly out and the view from our windows looking over the meadow land in front is very fine.

I think this place is as good as any when the warm weather is here, for it is so pleasantly situated. Lizzie is now much better and enjoys herself very much in thinking how she could make a garden and have a lawn, if the electric light were only paying a dividend. The light will soon show itself to the public again, I think in a slightly improved form, and lots of experience behind it. We shall show 300 or 400 scattered through the streets here, or rather in the fields, for the streets are more imaginary than real. I am now through with the steamer Columbia as it sailed yesterday for San Francisco with the lights aboard.

I hope that every thing will go well and see no reason to anticipate trouble. It will please the Californians when it arrives and be of use to the vessel. There will be in the future a great many steamers to fit with the light and this will be quite a profitable business in itself.

Lizzie's brother Will is here spending Sunday with his wife and baby.

I am glad to hear
from mother that the
invalids of the family
are all better and hope
the warm weather will
make all feel quite
well
Your Loving Son

Francis R. Upton

X-E6298

Moses Farmer
Aug. 11, 1880.

Torpedo Station
Newport, R. I.
Aug. 11th 1880.

Friend Edison—
I ought to have thanked you sooner for your kindness in sending one of your lamps to me by Mr. Stearns— & I now do it at this late day— I think that Mr. Stearns wrote that he got the lamp as far as [illegible] without accident— but before he sent it to me the carbon got broken— When it arrived at my hands it was broken into three

pieces — one about $\frac{1}{8}$ inch long — one about $1\frac{1}{4}$ & the longest not far from $1\frac{5}{8}$ — thus making its total length near to $2\frac{7}{8}$ inches. Since it was broken — I thought it a good opportunity to measure its width & thickness two points which I desired to know. — So I filed off the top of the globe & turned out the Carbon on to a sheet of paper & counted the pieces — 39 in all !! — I suppose that the inrush of air shattered it — some were not more than $\frac{1}{32}$ inch long — some were $\frac{3}{8}$ inch &c. I managed

with delicate tweezers to get pieces into my gauge so as to get the thickness $t = .00518$ & the width $w = .014566$ inch. Hence wt or cross-section $= .0000754588$ & its volume $lwt = .00022355$ c.i. So that if $\frac{1}{10}$ of a horse power be expended in one of them as it was in some of the experiments of Prof. Rowland & Barker — it would amount to $\frac{1}{.000223}$ = ~~[illegible]~~ 446. H.P. per cubic inch of Carbon — Now I think that this 446 horses tramping on a cubic inch of Carbon for 1700 ~~[illegible]~~ hours would be

X-E 6298 5
1880-08-11

quite likely to give it to poverty. —

By the Way. with all due deference to Prof. Rowland's Mathematical Skill — I must take exception to his formula for the average light of your lamps — he sets it too low — by giving $\lambda = \frac{1}{2}L + \frac{\pi}{4}l$ it should be

$\lambda = \frac{2}{\pi}(L + l)$ in this

case $\lambda = \frac{2}{\pi}(L + \frac{1}{3}L) = \frac{2 \times 4 L}{3 \cdot \pi}$

or $\lambda = .8488 L$ instead of $\frac{3}{4}L$ nearly as he gives it —

[4]

So taking their tabulated results we have

Lts	λ	$\frac{33000}{F.P.}$	$\frac{C.P.}{H.P.}$
17.5	13.85	9.47	140.63
13.5	11.46	9.32	106.81
38.5	32.67	6.37	208.10
44.6	37.85	6.74	255.10
19.0	16.12	13.29	214.23
12.2	10.35	9.91	102.56
17.2	17.20	12.18	209.49

add Morton's results

15.00	12.72	11.94	152.38
	14.13 av.		173.66

$\frac{173.66}{3} = 57.88$

1st column the amount of light emitted perpendicular to the carbon loop — Col 2 average light in all

direction — Col. 3
No. ft. lbs. per minute in
one H.P. divided by the
no. of ft. lbs. per minute
needed to produce the
light according to their
experiments — Col. 4
is the no. of Candle light
per horse power —
The Morris Engine
at the Lowell pumping
Station does 1 H.P. on
1¾ lbs. of coal per
hour — If we take the
lowest net efficiency of
your Dynamo at .785
as given by Prof. Barry &
Brackett — take 1 H.P.
as at Lowell — we
get $\frac{1.75}{.785} = 2.23$ &
again taking 173.66 C.L.

per H.P. we get
$\frac{173.66}{2.23} = 77.8$ or nearly
78 Candles per lb. of
Coal per hour — &
this I have no doubt
you can get if the
tramp of the 446
horses per cubic inch
of Carbon does not
destroy the loops too
often. ——
And on the other
items of interest it may
be well to notice —
For instance — the total
incandescent surface of the
loop which I had $2.4(.047) = .113$ 3-3
The maximum candle light
divided by this is $\frac{37.81}{.113} = 335.$
or three hundred thirty five

Candles per sq. inch
of heated Carbon surface —
while 62½ Candles per
total sq. inch of Platinum
surface is the highest
that I remember to
have measured. —

The average of the
Rowland & Barker &
the Morton Experiment
$= \frac{19,15}{113} = 169,47$ nearly 170
Candles per sq. inch —
supposing the Carbons in
their experiment to average
the size of the one
which I had. —

The resistance of
Morton's Carbon when
Cold was 123 ohms.
when hottest was 75.

equal to a fall of 39
percent by heating —
Mine when Cold was
128. So we may suppose it to be 61 percent
of that or 78 when
hot, hence its "specific
resistance" — or the
resistance between opposite
faces of an inch cube
would be $= \cancel{R} \; r_{cold} = \frac{R.w.t}{l}$
$= ,003326$, hence any
Carbon of this Character
would have its resistance
when cold expressed by
this formula $R = \frac{.003326 \times l}{w \times t}$

Again I have found
that the current necessary
to fuse a platinum strip

is expressed with
tolerable accuracy by
this formula

$$S_{max} = \frac{6(w+t)}{\left(\frac{w}{t}\right)^{\frac{1}{3}}}$$

Now if the Carbon in
lamp 580 in R & B's
experiments was of the
same dimensions as the
Carbon in the lamp which
you sent me; if too
its resistance when cold
was 147 ohms, & when
hot was 89,67 ohms
then the current while
giving a light of 44,4 candles
must have been not
far from $1{,}111 = \left(\frac{4899}{44{,}27 \times 89{,}67}\right)^{\frac{1}{2}}$

or about ten ninths of
a weber — hence for any

other Carbon of different
dimensions we should expect
it would withstand, for
a time at least a current
of $\frac{1{,}111}{{,}01546} = 71{,}86$ nearly 72
times $\frac{(w+t)}{\left(\frac{w}{t}\right)^{\frac{1}{3}}}$ or

$$S_{max} = \frac{72(w+t)}{\left(\frac{w}{t}\right)^{\frac{1}{3}}}$$ now

for platinum the
coefficient 72 must be
replaced by the number
580, thus shewing that
it takes a current nearly
eight times as strong to
fuse a platinum bar, as
it does to give 335 candle
from a Carbon bar of
same dimensions — &
the light from the

Carbon will be several
times as intense as from
the platinum, — Moreover
the platinum increases ~~the~~
its res resistance more than fourfold
while the carbon diminishes
some forty percent — when
heated — So you have
everything to encourage
you & I say persevere —
& luck will help you
to see eighty Candles
from one lb, of coal
per hour from
Incandescent Carbon.

Truly yours —
with thanks
M. G. Farmer.

[12]

x-E6298
1880-08-12

Princeton N.J.
August 12 1880-

My dear Mr. Upton

The tubes came to hand yesterday & I tried them this morning - There is not the slightest evidence of any diminution of the E.M.F. (thermal) of platinum iron by removal of air, in fact the joinings in vacuo seemed if anything slightly to exceed in E.M.F. those in air - I laid the tube in sunlight, connecting terminals with delicate galvanometer by iron wires - at least they were iron for a foot or two from the tube - then copper of course

If all the joinings were exposed to sun there was no effect on needle: shade any one and it moved: shade all but two - one in the tube & the adjoining one outside, & the joining in tube always prevailed slightly - as might have been expected, since the glass prevents the joining under glass from losing heat as fast as the other - acting like a hot-house cover.

I had not time to try the effect of covering the outside joinings with similar tubes but - will bye & bye.

So if Exner is not altogether mistaken his conclusion holds for nothing but Antimony & Bismuth, oxygen & Nitrogen, & must not be extended to any other bodies except upon special trial -

Can you without much trouble tell me how far the exhaustion was carried in the two tubes, would a spark pass - I suppose I could melt the iron & try, but fear I should break the tube.

I need hardly say how much I am obliged to you & Mr. Edison for your help in this matter - I am really more grateful than I can well say

Have you seen Clarks(?) (I am not sure of the name) statement about the power of a magnet wound with iron wire? I half believe he is right, and that a magnet for a dynamo

made with a soft iron core of say two inches diameter & then wound up with three or four parallel strands of that square wire until it was six inches diameter would do better work than a copper wound magnet.

Yours truly
Geo. Young

Geo. Young
Aug. 12, 1880.

T. A. EDISON,

X-E62859
1880-11-04

Menlo Park, N. J., Nov 4 1880.

Received from Francis R Upton seven hundred and fifty dollars on account of Lamp Factory

$750.

Thomas A Edison
Careman

T. A. EDISON,

X-E62-85-9
1880-11-18

Menlo Park, N. J., Nov 18 1880.

Francis R Upton
Dear Sir
I have this day charged to your a/c \$875 57/100 being 5% on \$17511.41 as per agreement this includes everything from the start of Lamp Factory. I gave you a receipt for \$750 which amount is credited to you on the Books

Very truly
Wm Carman

X-E62-85-9
1880-11-18

T. A. EDISON,

Menlo Park, N. J., Nov 18 1880.

Received from F. R. Upton one hundred & twenty five $\frac{54}{100}$ dollars proportion to date on account of Lamp Factory now called Edison Electric Lamp Company

T A Edison

Wm Carman

Receipt for
$125 on acct
Lamp Factory
Nov 18, 1881

(#39)
E-6124-39

Menlo Park.
Dec 27th 1880.

My Dear Sadie
Your cards came on Christmas morning, and the socks from Mrs. Farley will you please thank her for them. Elsie was very well remembered. As Carrie Potter sent her a hood. Aunt Hannah a rubber doll, Lillie and Sallie a silver knife fork and spoon. Grandma Perry a music box. and large card. The boys. a promise of a Carriage. and Mrs George Upton the tips. she was delighted with all. I had two roses from Frank. and if

Frank does as he thinks he will now. You will have your bangle before long. Don't be discouraged but "Hope on". Mother took cold coming on and has not been very well since she arrived but today is better. Our furnace would not draw on Sunday and we thought we should freeze so Frank sent for the tinmen and they have put a flue on top of the chimney and we hope it will help it. They also fixed the air box and I hope it won't be so dusty. The boys have gone, John & Pillsbury to attend a German at a Mrs

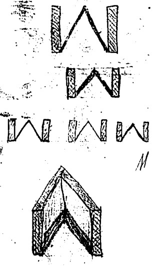
Mason's house who goes to school at Andover. It is a long way to go to a dance but they think it is so lovely here. Rob has gone to Brunswick. The Electric light is lovely now I do wish you could see it. We are to have it in here tonight all the streets are lighted and all over the fields. Jay Gould is coming out to see it tonight and Dudley Sargent is coming out here tomorrow night with his lady. There is quite good sleighing here, and the Edisons were out this morning. It is very cold here. Almost like Brown Ezli. Did you know that Mr. Kempson

name was Saint George! -
What did you have for
Christmas? and tell
me of the wedding
which comes off tomorrow
night. what are you to
wear? I am glad
Edgar is better, and I
hope your Mother is also.
Elsie is just as goodly
as can be. and looks
so sweet and lovely. Frank
is very well but worked
all night last night and
~~today~~ as well. We are going
~~to have~~ an elegant brass
chandelier for the parlor!!
Lots of love to all
Yours the nicest
Lizzie F. P. W.

Formulae
Resistance Lamps

1880

X=E 6298



X-E6298
1880-
1.

General Formula for resistance

Let m = resistance of 1 inch, .001 sq.

R = The resistance of a body
$a \times b$ = cross section
l = length

$$R = \frac{l}{a \times b}\, m \qquad m = \frac{abR}{l}$$

Surface = S
$S = 2(a+b)l$

For a lamp to give in the same circuit ~~two times~~ one half the light with the same economy it must have one half the surface and twice the resistance.

Let l' = length
& a' = the sides
b' =

$$b' = -\frac{4}{2} \pm \sqrt{\frac{850}{4} + \frac{16}{4}}$$

212.5
4
216.50 (14.7
1
24) 116
96
287) 2050
2009
41

12.7

$\overline{2}.945642$
1.187521
.133163

1358

4.074

$\overline{2}.945642$
1.103804
.849446

1120
4
4.480

$$b' = -\frac{5}{2} \pm \sqrt{\frac{850}{5} + \frac{25}{4}}$$

170
6.25
176.25

13.27
2.5
10.77

(2).246018
1.123009

$\overline{2}.945642$
1.032216
$\overline{1}.977858$
.689970
.676828

4.751

XE 6399 2.

$$2R = \frac{l'}{a'b'}\, m \qquad \frac{2R}{m} = C$$

$$C = \frac{l'}{a'b'}$$

$$\frac{S}{2} = 2(a'+b')\,l' \qquad \frac{S}{4} = D$$

$$D = (a'+b')\,l'$$

There are three unknown quantities and only two equations so that the conditions of the problem are satisfied with any length or dimension that may be fixed upon.

Let $a' = a$

$$Ca = \frac{l'}{b'} \qquad l' = Cab'$$

$$D = al' + b'l'$$

$$D = Ca^2b' + Ca\,b'^2$$

$$b'^2 + ab' = \frac{D}{Ca}$$

$$b'^2 + (\ ) + \frac{a^2}{4} = \frac{D}{Ca} + \frac{a^2}{4}$$

$$b' + \frac{a}{2} = \pm\sqrt{\frac{D}{Ca} + \frac{a^2}{4}}$$

$$b' = -\frac{6}{2} \pm \sqrt{\frac{850}{6} + \frac{36}{4}}$$

141.33
9
150.33

(2.177046
1.088520

12.26
3
9.26

$\bar{2}.945642$
.966611
~~$\bar{1}.979031$~~
.778151
5
~~.757182~~
$\bar{1}.912253$
.690404

$$b' = -\frac{7}{2} \pm \sqrt{\frac{850}{7} + \frac{49}{4}}$$

121.4
12.25
133.65

(2.1258
1.0629

11.56
3.5
8.06

$\bar{2}.9456$
.9063
$\bar{1}.8519$
.8451
.6970

$$b' = -\frac{a}{2} \pm \sqrt{\frac{D}{ca} + \frac{a^2}{4}}$$

$$l' = cab'$$

$R = 185$ Ohms

$m = \frac{abR}{l} = 4193$

$l = 6.$

$a = 17.$

$b = 8.$

17
8
136
185
680
1088
136
6)25160
4193 Ohms

$C = \frac{2R}{m} = .0882$

185
2
4193) 370.00 (.0882
33544
34560
33544
10160

$S = 2(a+b)l = 300$

17
8
25
2
50
6
300

$D = \frac{S}{4} = 75$

X-E6298 4.

$b' = -\frac{8}{2} \pm \sqrt{\frac{850}{8} + \frac{64}{4}}$

106.25
16
122.25

11.05
4
7.05

2.0871
1.0435

2.9456
.8482
.9031
.6969

$b' = -\frac{9}{2} \pm \sqrt{\frac{850}{9} + \frac{81}{4}}$

94.44
20.125
114.7

2.0596
1.0298

10.71
4.5
6.21

4.93

2.9456
.7931
.9542
.6929

$b' = -\frac{a}{2} \pm \sqrt{\frac{D}{Ca} + \frac{a^2}{4}}$

$2\overline{)17}$
$8.5 = \frac{a}{2}$

.0882
17
6174
882
1.4994 = Ca

$1.5 \overline{)75} (50$

$\frac{D}{Ca} = 50$

17
17
119
17
$\frac{a^2}{4}$ $4\overline{)289}$
72.25

72.25
50
122.25 (11.05
1
21) 22
21
2205) 12500

$b' = -8.5 \pm 11 = 2.55$

$l' = c\,a\,b'$

$l' = \cancel{3.75}$ 3.82

2.55
1.5
1275
255
3.825
1.95
191
19125
34425
3.825
7428

1.5
2.55
75
30
3.75

2.5
17
19.5
325
3875
1388
5825
73.125

Surface = 74.78 X 2 = 150
= 75 X 2 = 150

$$f' = -\frac{10}{2} \pm \sqrt{\frac{850}{10} + \frac{100}{4}}$$

850
25
110.0

2.0414
1.0207

10.49
5
5.49

$\bar{2}$.9456
.7396
1.6852

4.84

$$f' = -\frac{11}{2} \pm \sqrt{\frac{850}{11} + \frac{121}{4}}$$

7.72
3.42
5.24

$\bar{2}$.9456
~~.7193~~
~~1.0414~~
~~.7063~~

5.086

10.36
5.5
4.86

77.2
30.2
107.4

2.0310
1.0155
$\bar{2}$.9456
1.6866
1.0414
.6736

4.72

X-E6298 5.

Let $a' = f'$

$C = \frac{l'}{a'^2}$ $l' = Ca'^2$

$D = 2a'l'$ $l' = \frac{D}{2a'}$

$D = 2Ca'^3$

$a'^3 = \frac{D}{2C}$

$M = 4193$

.0882
2
$2C = .1764$

.1764) 75.0000 (425.1
7056
4440
3528
9120
8820
3000

$a'^3 = 425.1$

$a = 7.52$

$l = 4.985$

$l = 5$

3 | 2.628491
.876164

.876164
$\bar{2}$.945469
.697797

7.52
4
30.08

30.08
5
150.4 = Surface

$$b' = -\frac{12}{2} \pm \sqrt{\frac{850}{12} + \frac{144}{4}}$$

70.83
36.
106.83

10.33
6.
4.33

4.58

$\overline{2}.0286$
1.0143

$\overline{2}.9456$
.6365
1.5792
.6613

$$b' = -\frac{14}{2} \pm \sqrt{\frac{850}{14} + \frac{196}{4}}$$

14)850(60.7
84
100

60.7
49.0
109.7

10.47
7.
3.47

4.282

$\overline{2}.0402$
1.0201

$\overline{2}.9456$
.5403
1.1461
.6320

14
14
56
14
196

X-E6298

6.

Form A page 1.

For a lamp to give in circuit with other lamps $\frac{1}{n}$ the light with the same economy, its surface must be $\frac{1}{n}$ times that of the original and its resistance n times the original.

Let l' = length
& a' = one side
b' = other "

$$nR = \frac{l'}{a'b'}\,m \qquad \frac{nR}{m} = C$$

$$(1)\quad C = \frac{l'}{a'b'}$$

$$\frac{S}{n} = 2(a'+b')l' \qquad \frac{S}{2n} = D$$

$$(2)\quad D = (a'+b')\,l' = a'l' + b'l'$$

There are three unknown quantities and only two equations so that any one of the three dimensions must be fixed in order to obtain a solution.

$$b' = -\frac{1}{2} \pm \sqrt{\frac{3400}{9} + \frac{1}{4}}$$

$$= -\frac{1}{2} \pm \quad 377.77$$

.25

378.02 $\quad$ 2.5775

1.2887

19.44

.5

18.94

$\frac{17}{8}$

13.6

$\frac{12}{136} = \frac{6}{68} = \frac{3}{34}$

.4771

1.5315

$\bar{2}.9456$

$\frac{2l}{ab} = .0882$ $\quad$ .3988

$\frac{l}{ab} = .0441$

3

.1323 $\quad$ $\bar{1}.1216$

18.94 $\quad$ 1.2772

~~3.154~~ $\quad$ .3988

2.505

$$b' = -\frac{2}{2} \pm \sqrt{\frac{3400}{18} + \frac{4}{4}}$$

3.5315

1.2553

2.2762

(2.2785 $\quad$ 188.9

1

189.9

$\frac{13.78}{12.78}$ $\quad$ 1.1392

$\bar{1}.1216$

1.1065

.3010

.5291

3.38

Let $a' = \cancel{x}$

$$c = \frac{l'}{\cancel{x}b'} \, 144 \qquad l' = \frac{\cancel{x}b'c}{144}$$

$$D = \cancel{x}l' + b'l$$

$$D = \cancel{x}^2 b'c + \cancel{x}b'^2c$$

$$b'^2 + \cancel{x}b' = \frac{D}{\cancel{x}c}$$

page 3

$$b' = -\frac{\cancel{x}}{2} \pm \sqrt{\frac{D}{c\cancel{x}} + \frac{\cancel{x}^2}{4}}$$

$$l' = c\cancel{x}b'$$

$$b' = -\frac{\cancel{x}}{2} \pm \sqrt{\frac{\frac{S}{2n}}{\frac{nR}{m}\cancel{x}} + \frac{\cancel{x}^2}{4}}$$

$$= -\frac{\cancel{x}}{2} \pm \sqrt{\frac{mS}{2n^2R\cancel{x}} + \frac{\cancel{x}^2}{4}}$$

$$\frac{mS}{R} = 65000 \qquad 4193$$

$$l' = \frac{nR}{m}\cancel{x}b' \qquad m = \frac{abR}{l}$$

$$\frac{m}{R} = \frac{ab}{l}$$

$$\frac{R}{m} = \frac{l}{ab}$$

9) 1699.75
187.64

2.272770
.757590
.477121
1.234711
1.875061
.640350

1699.75
424.99
106.27

2.026475
.675805
.612060
1.277865
1.875061
.597196

$$b' = -\frac{17}{2} \pm \sqrt{\frac{3400}{9 \times 17} + \frac{17^2}{4}}$$

9
153

17
17
119
17
289
72.25

3.531479
2.184691
1.346788

72.25
22.2
94.45

1.9752
0.9876

9.72
8.5
1.22

.1323

~~2.14~~

$\bar{1}$.1216
1.2304
~~.3510~~
.0864
.4384

X-E6298 8

R = 165
a = ~~k~~ = b = 12
l = 6
$m = \frac{ab\,R}{l} = 3960$

165
144
660
660
165
6) 23760
3960

17
8
136 ; 144 ; 165

144
136) 23760 (175 Ohms
136
1016
952
640
660

R = 175
~~x~~ = 8
b = 17
l = 6
m = 3966

17
8
136
175
680
952
136
6) 23800
3966

X-E6298

$m = 3966$ 9

$$\frac{m\ S}{R} = 6799.0$$

$= 68000$

page 3 $S = 3000$

3.966
300

$175 \overline{)1189800}$

1189800
175
6799.0

6.075475
2.243038
3.832437

$$b' = -\frac{\cancel{\alpha}}{2} \pm \sqrt{\frac{68000}{2n^2\cancel{x}} + \frac{\alpha^2}{4}}$$

$$= -\frac{\cancel{x}}{2} \pm \sqrt{\frac{34000}{n^2\cancel{x}} + \frac{\alpha^2}{4}}$$

Let $n = 2$

$$b' = -\frac{\alpha}{2} \pm \sqrt{\frac{8500}{\cancel{x}} + \frac{x^2}{4}}$$

~~$b' = \alpha - \frac{\alpha}{2} \pm \sqrt{8500}$~~

$x = a = 17$

17
17
119
17
289

$$b' = -\frac{17}{2} \pm \sqrt{\frac{8500}{17} + \frac{289}{4}}$$

$17 \overline{)85.00} \left(5.00 \right.$
$\underline{85}$
00

$\underline{289}$
72.25
$\underline{50}$
122.25

$X = a = 17$

$b' = -8.5 + 11.05 = 2.55$

$l' = \frac{nR}{m} \cancel{X} b'$ page 7

$l' = \frac{n l}{ab} \cancel{\times} b'$ $a = X$

$= \frac{nl}{b} b'$

$= 3.82$

12
$8/12$
1.5

2.55
$\underline{1.5}$
1275
$\underline{255}$
3.825

1.5
$\underline{2.55}$
$\cancel{75}$
$\cancel{30}$
$\cancel{3.75}$

$n = 2$

$\cancel{X} = 1$

$b' = -\frac{1}{2} \pm \sqrt{850 + \frac{1}{4}}$

850.25

$2 \overline{)2.929546}$
1.464773

29.15
$\underline{0.5}$

$b' = 28.65$

$.17$
$\underline{8}$
136

$l' = \frac{nl}{ab} \times b'$

$l' = .088235 \times b'$

136
$1.07918[1]$
$\underline{2.133539}$
$\bar{2}.945642$

$\ell' = 2.527$

$\bar{2}.945642$
1.457125
$.402767$

$n = 2$
$x = 2$

$b' = -1 \pm \sqrt{4250 + 1}$

4251 (~~65.2~~
36
125) ~~651~~
~~625~~
1302) ~~2600~~

426 (20.64
4
406) 2600
2436
4124) 16400

$b' = 19.64$

$\ell' = 3.46$

$\bar{2}.945642$
1.293141
$.238783$

1733
2
3.466

$n = 2$
$x = 3$

$b' = -\frac{3}{2} \pm \sqrt{\frac{850}{3} + \frac{9}{4}}$

$b' = 16.9$
1.5
$b' = 15.4$
$\ell' = 4.074$

283.3
2.25
285.55 (16.9
26) 185
156
329) 2955

X-E6298

n = 2	b′ =	12.7	
x = 4	ℓ′ =	4.48	
n = 2	b′ =	10.77	
x = 5	ℓ′ =	4.75	
n = 2	b′ =	9.26	
x = 6	ℓ′ =	4.90	
n = 2	b′ =	8.06	
x = 7	ℓ′ =	4.978	
n = 2	b′ =	7.05	page 14
x = 8	ℓ′ =	4.976	b′ = x = 7.51
n = 2	b′ =	6.21	ℓ′ = 4.987
x = 9	ℓ′ =	4.93	
n = 2	b′ =	5.49	
x = 10	ℓ′ =	4.84	
n = 2	b′ =	~~5.14~~ 4.86	
x = 11	ℓ′ =	4.72	
n = 2	b′ =	4.33	
x = 12	ℓ′ =	4.56	
n = 2	b′ =	3.47	
x = 14	ℓ′ =	4.286	
n = 2	b′ =	2.65	
x = 17	ℓ′ =	3.82	

Page 9

$$b' = -\frac{x}{2} \pm \sqrt{\frac{3400}{n^2 x} + \frac{x^2}{4}}$$

$$l = \frac{nl}{ab} \times b'^2$$

$n = 3$ $\quad b' = 18.9$

$x = 1$ $\quad l' = \cancel{9.154}\ 2.505$

$n = 3$ $\quad b' = 12.78$

$x = 2$ $\quad l' = 3.38$

From page 7

Let $b' = x$

$$C = \frac{l'}{x b'} = \frac{l'}{b'^2}$$

$$D = x\cancel{b'} + b'l' = b'b' + b'l = 2b'l'$$

From page 6

$$nR = \frac{l'}{a'b'}\, m$$

$$\frac{S}{n} = 2(a'+b')l'$$

Let $a' = b'$

$$nR = \frac{l'}{b'^2}\, m \qquad l' = \frac{nR}{m}\, b'^2$$

$$\frac{S}{n} = \cancel{2}4\, b'l' \qquad l' = \frac{S}{4nb'}$$

$$\frac{n^2 R}{S} = \frac{m}{4b'^3}$$

$$\cancel{4}b'^3 = \frac{mS}{4n^2 R}$$

page 9 $\quad \frac{mS}{R} = 6799$

X-E6298

14

$$b'^3 = \frac{6799}{4n^2} = \frac{1699.75}{n^2}$$

$$l' = \frac{S}{4nb'} = \frac{300}{4nb'} = \frac{75}{nb'}$$

$n = 1$
$b' = a' = 11.93$
$l' = 6.28$

3.230193
194
3)3.230387
1.076795
1.875061
.798266

$n = 2$
$b' = \cancel{4.77}\ 7.51$
$l' = 4.987$

4)1699.75
424.99
3)2.628389
.876129
301030
1.177159
1.875061
.697902

$n = 3$
$b' = a' = 5.722$
$l' = 4.369$

$n = 4$
$b' = 4.741$
$l' = 3.955$

$n = 3$ $b' = 1.22$
$a' = 1$ $l' = 2.74$

Page 15 taken out

Summary

For a lamp to give in the same circuit with another lamp $\frac{1}{n}$ the light using the same number of ft. lbs. to give a candle, its surface must be $\frac{1}{n}$ that of the original and its resistance n times as great.

Let l = length carbon in original
a & b = width and thickness
S = surface
R = resistance

m = resistance of sq. mil inch before carbon

The same numbers primed represent the dimensions of the other lamps.

$$S' = \frac{S}{n} \qquad R' = nR$$

$$S' = 2(a'+b')\,l' = \frac{S}{n}$$

$$R' = \frac{l'}{a'b'}\,m = nR$$

As original lamp then is taken one in which $R = 175$ ohms, $a = .008$, $b = .017$ & $l = 6.000''$

Then $S = 300$ and $m = 3966$

X-E 6298

$$b' = -\frac{a'}{2} \pm \sqrt{\frac{mS}{2n^2Ra'} + \frac{a'}{4}}$$

$$l' = \frac{nR}{m} a' b'$$

$n = 2$ That is 8 candles 350 ohms

$a' = 1$	$b' = 28.65$	$l' = 2.530$
$a' = 2$	$b' = 19.64$	$l' = 3.460$
$a' = 3$	$b' = 15.4$	$l' = 4.070$
$a' = 4$	$b' = 12.7$	$l' = 4.48.$
$a' = 5$	$b' = 10.77$	$l' = 4.75.$
$a' = 6$	$b' = 9.26$	$l' = 4.9$[illegible]
$a' = 7$	$b' = 8.06$	$l' = 4.978$
$a' = \cancel{7}.51$	$b' = 7.51$	$l' = 4.987$
$a' = 8$	$b' = 7.05$	$l' = 4.976$
$a' = 9$	$b' = 6.21$	$l' = 4.93$
$a' = 10$	$b' = 5.49$	$l' = 4.84$
$a' = 11$	$b' = 4.88$	$l' = 4.72$
$a' = 12$	$b' = 4.33$	$l' = 4.58$
$a' = 14$	$b' = 3.47$	$l' = 4.286$
$a' = 17$	$b' = 2.55$	$l' = 3.82$

Summary History from Motts notes

X-E-6298

April 11, 1880 Rails laid Ten men working

" 17 Reverse lever drawings made

May 12 Motor for R.R. tested in shop

" 14 Motor fitted with belts and pulley showed force enough to but side out of station.

May 18 Passenger carried by motor.

May 25 Motor ran off lower end of track breaking pulley.

" May 26 Electric head light and bell pull put on engine

May 29 ~~2 No~~ Two men employed in extending road

June 5 Men extending road

" 8 Ties from P.R.R. being drawn up for use on elec R.R extension

15 Switch on motor covered

June 21 Ties being drawn from P.R.R depot for extension

June 26 "Ten more cars ~~of~~ loads of ballast dumped for Mr. E."

July 23-24 N.Y. Herald articles

" 26 "Cuban R.R. men for electric R.R. rights"

Diary E. P. Mott. X-E6298

April 10 1880 Pushing tramway work along as fast as possible -

April 11 Electric tramway. pushing work on road today ~~the~~ the track gang of R.R. on the work laying the rails in all ten men on the work today.

April 13 1880. ~~Prony~~ Prony ~~brake~~ dynamometer tests made ~~[illegible]~~ on generator as motor ~~&~~ in Laboratory gets two horse power. Book 59 68.100 lbs.

April 16 Elec Tramway ayres drawing from depot long timbers for tunneling (sic) and men at work on tunneling (sic) building.

April 16 Reverse lever. John Ott at work on lever apparatus to reverse the magnets and brushes to control the movement of car on tramway. Book 80 Page 156

April 17 Reverse switch ~~for~~ for tramway devised and sketch given to Ott from which to construct the same. patterns for castings.

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April 18 Elec Tramway. 3 men grading and straightening track, three laying and skinking (sic) and three at tracking (sic) and other work connected.

April 20 Station Elec Tramway Moffett & T— Commenced on station 14 X 18 for Elec tram. Ayres drawing more rails.

April 21 Horning making sketch of electric locomotive.

April 22 Breath making Pat. office drawing.

April 23 Tramway station. Horning designed and made sketch of dynamo station especially adapted to control movement of trains of electric tramway.

April 27 Winding locomotive magnets with ten layers of .016 wire.

April 27 RR graded around the turn or first crook.

April 28 Loco. magnet wound with .049 wire charged and by allowing the block of iron ~~the~~ such as used on top of generator to come in contact with the poles. Horning calculated the power ~~wgt~~ required to force by peg (sic)

one end loose from magnet to be 1400 lbs

April 30. ~~P~~ Tramway. Rails spiked as far as ties will permit -

May 1 Conductor to lamps up RR, 6 strands each No. 10 being run.

May 3 Tramway car castings delivered

May 8 Wheels and other castings for elec tramway received this A.M. ~~[illegible]~~ seats put in cars.

May 10 Cables to RRoad put in this a.m. 4 strands No. 10 wire were run into station, five circuits in all from ~~Dyn.~~ Dyn. room.

May 11. Road bed of E. tramway all ballasted up and ready ~~fo~~ to receive the cars.

May 11 RR. connections made with rails and switch board put in by Force.

May 12 RR. motor raised off of floor and ran like a top.

May 12. Tests of motor by Upton Book 48 page 53 - comparative tests with Bradley methods for power and [illegible] governing

May 13. Comparative tests by Prony and Bradley methods being made by Mr. Upton.

May 13 Elec. tramway completed and tried electrically. O.K. Engineeringly one of the friction gear wheels smashed. Lamps put in station & men repairing.

May 14. Gear sketches for application to elec tramway eng. (sic) brought ~~into~~ in Mr. Wilbur's book in office. put in Mr. Wilbur's book.

Test of motor Book 48 page 61

May 14 Elec. Engine fitted with belt and pulley gear and tried with sufficient force to burst side out of station.

~~G~~ Gear for elec engine is the absorbing topic for conversation.

May 15. ~~Gearing~~ Gearing for elec. tramway sketches for different ideas Book 51 page 167 &c by Batchelor & Honig. one of gear on wedge principle on Page 179.

Eng. of Elec. Tramway tests with and repairs of.

Tuesday May 18 Generator moved from dynamo station into old station to be used for current ~~to~~ for tramway. The motor with one machine on was run the full length of track and return. with the two generators on the two cars were run to ~~same~~ end of track and back with 9 passengers without any ~~d~~ difficulty quite a party of foreign naval officers enjoying the ride and London citizen.

May 19 Indicating. Mr. Clarke taking indicator cards while the Elec. engine was running

May 20 Mott finished the P.O. drawings and Mr. Wilbur specifications for patents on magnetic engine RR &c.

May 25 Magnetic engine again equipped and run off lower end of track breaking large pulley.

May 26 Elec. head light and bell put on engine and platform extended around RR. station

May 28. First Flood. turkey ran over, engine working first class.

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May 29 Two men preparing to extend RR.
4 ~~"~~ ballasting old ~~track~~ track
" Friction gear Napier (sic) two models
received to study their adaptability to the
electric locomotive

May 30 Tests of track made

June 1 Mention of friction "brake"

June 2 Gear Mr. Honig is making calculations
and drawings for using Mason's clutch
" and wire rope for elec. tramway 1&8.

June 3 Visitors from Columbia S.A.
rode over RR: in 1½ minutes coming
up with full load. at one min (sic)
the 2250 feet of track requires 2250
revolutions of armature.
Cars. part of castings for cars (3)
were recd this A.M.

June 4 Car frames - Carpenters getting out.

June 5 Visitors Mr. Goddard & Mr. Lowry
had ride on road, ran off track at
curve. No one hurt nothing broken.

June 5 Two or three men extending track
of RR.

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June 8. Ties from ~~R.R.~~ Penn. R.R. being drawn up for use on the tramway extension.

June 11 Men working on extension.

June 14 Car box side boards put on track 16 persons brought up successfully.

June 15 R.R. motor wire connections & con- (word not plain) and switch covered

Gear hand over hand clutch gear to climb by clutching the rails in front of motor sketched by Mr. Horning.

June 16 R.R. track men of Penn R.R. worked about two hours on track tonight.

June 19. Team and men on R.R. extension.

June 21 Ties for R.R. being drawn from depot old ties P.R.R.

June 26 Ballast ten more car loads dumped today for Mr. E.

July 2. R.R. Station platform and end taken out connections changed.

July 2 Large Elec Locomotive armature sleaved (word looks like this) on driving axel with clutches for gen. Railroading

July 3 R.R. Station end removed and made ready

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July 3. Pullman Car put on track
July 7 Pullman car raised for putting on the mag-
~~at~~ nets &c for brake. ~~ss~~

R.R. armature repaired and machines
connected in multiple in N.S. in series
100 volts great power and speed.
July 9 Magnetic Brake trying it practically on
box car
July 10 Gang on RR at work
July 16 Insulating Track commenced putting
tarred felt under R.R. Rails to insulate
July 21 Elec. Engine Clarke deep in investigation
and study of proper design of powerful
electric locomotive and also on rail
insulator Book 115 Page 1 &c
Gear. New Man commenced putting new gear
on elec. locomotive.
July 22 Dynamometer open car 16 lbs.
to start two cars open and box
64 lbs. Thirty (sic) to keep both
~~ss~~ moving. 40 lbs wen (sic) running on current
to move engine 86 lbs to keep moving 64 lbs

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July 22 Gear Man putting arm and clutch gears on electric locomotive.

July 23 New York Herald published this morning a long descriptive article on the electric R.R. and its adaptibility to elevated roads.

July 24 Papers Herald today has also another article on Edison electric ~~RR~~ locomotive.

July 26 Cuban Rail Road men for electric RR. rights.

July 27 Prof Barker &c sent box car down track 4 passengers car ran hard and boxes heated.

July 28 RR. Three dynamos currents applied to Rail Road more power & speed less work on dynamos.

Aug 5 Clutch to work on driving wheels instead of rails Book 135 p 65 &c

Aug 6 RR. ran successfully. Second trip cross on short circuit found through metalic dust setted in commutator. washers connected and (tried?) burned out ~~an~~ armature of one machine in dynamo room.

Aug 7. the magnet taken out and rewound.

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Aug 9. Logan at work putting gear on elec Locomotive

Aug 20 Men cut weeds from track and put in rediness for running.

Aug 21 Locomotive gear run to — and grind down armature in shop burned out before complete test.

~~Man~~ Men gearing ~~the~~ electric locomotive.

Aug 23 Locomotive tried crafer passable, friction clutch slow speed ~~we~~ very weak.

Aug 24 Short circuit in wires leading to rail-road track

Aug 25 Locomotive friction gear taken out to improve the clutch.

Copy Ledger Lamp Factory X-E6298 1880-1882

1881 F.R. Upton.

Jan 8	To Carman bill	2	50	Dec 18 1880	By Sundries ✓	875	57
6	" C. T. Hughes	1	00	Jan 7 1881	By Expense	6	32
10	" Maskun & Robbin		44	8	" Cash	10	00
13	Hughes		65	11	" Runyon's bill	10	00
29	Cash ✓	100	00				
Feb	Balance	1625	57	12	" Cash	10	00
				13	" "		66
				21	" " ✓	600	00
				28	" Sndrs. ✓	217	61
		1730	16			1730	16
Feb 19	To ~~Lafonge~~	~~2~~	~~50~~	Feb	By balance	1625	57
Jan 31	" ~~coal~~	27	54	Jan. 31			
Mch	" Balance	2195	53	Feb. 23	Check ✓	600	00
~~May~~	"	2225	57			2225	57
May	To balance	5271	10	Mch	By balance	2195	53
				apr. 6	T. A. Edison 1/20 ✓	2225	57
				12	Check ✓	850	00
						5271	10
May 19	To Capital	875	57	May	By Balance	~~5271~~	10
" 24	" Cas % Jan 26th acc	750	00	" 19	" 10% accr ✓	1250	00
" 27	" " Feb. 22	600	00	" 31	" balance	30	04
"	" " Apl 16	850	00				
"	" " May 17	1250	00				
" 28	Entry April 6	2225	57				
		6551	14			6551	14

1881 X-E6298

June 1. To balance	30	04	July 9 By Cash 100 7/8 acc	✓ 1200	00
July 8 " Capital acct	1000	00	" 30 " Balance	30	04
29 " Cash	✓ 200	00			
	1230	04		1230	04
Aug 1 To Balance	30	04	Aug. 5 By Cash	✓ 1200	00
16 " Capital acct	1000	00	13 " "	✓ 1000	00
20 " Cash	✓ 1000	00	20 " "	✓ 525	00
Sept 3 " "	100	00			
Balance	594	96			
	2725	00		2725	00
Oct. 3 To Cash	✓ 1153	95	Sept. 1 By balance	594	96
to page 34 Balance	889	28	27 " Cash	✓ 294	32
			Oct 1 " "	✓ 1153	95
	2043	23		2043	23
Oct. 1 To Cap a/c Acme 11	1000	00	Oct. 3 Balance	889	28
Sept 19 " Expense	2	75	22 Cash	✓ 1325	00
Oct " " Balance	2236	53	29 " ✓	1025	00
	3239	28		3239	28
Nov. 3 Pattern Bros	3	00	Nov 1 By balance	2236	53
5 " Cap a/c	1000	00	19 " Cash	✓ 100	00
14 " Cash	✓ 900	00	28 " "	✓ 1100	00
30 " Balance	1633	53			
	3436	53		3436	53

X-E6298

1881							
Dec. 3	To McKesson & R	9	36	Dec 1	By balance	1533	53
14	" Power acct	2	98	3	" Cash	✓ 150	00
17	" Cash	✓ 1000	00	10	" "	33	00
20	" Cap Acc	1000	00	17	" "	✓ 1250	00
20	" Cash	✓ 720	00	20	" "	✓ 712	00
23	" "	✓ 1200	00	23	" "	✓ 1100	00
31	" Balance	846	19				
1882		4778	53			4778	53
Jan 25	To Cash	✓✓ 1275	00	Jan 2	By Balance	✓ 846	19
" 31	" Balance	✓ 1125	30	2	" Fund	✓ 279	11
				21	" Cash	✓✓ 1275	00
1882		2400	30			2400	30
Feb. 11	To Cash	✓✓ 2500	00	Feb. 1	By balance	✓ 1125	30
" 9	" Power Acct	✓✓ 52	79	10	" Cash	✓✓ 2500	00
" 28	" European Electric Co.	✓✓ 500	00	28	" "	✓✓ 111	83
" 28	" Balance	684	34				
		3737	13			3737	13
Mch 8	To Cap Account	✓✓ 1000	00	Mch 1	By balance	684	34
31	" Balance	5000	00	" 8	" Cash	✓✓ 672	63
				"	" "	✓✓ 1456	19
				" 9	" "	✓✓ 1000	00
				"	" "	✓✓ 126	53
				"	" "	✓✓ 2060	31
		6000	00			6000	00

1882 X-E6298

April 22 To Cash	300	63	April 1 By balance	5000	00
" " " "	√√ 513	12	5 " Cash	√√ 3500	00
" " Balance	8500	00	18 " "	√√ 513	12
			22 " "	300	63
	9313	75		9313	75
May 31 To Balance	12358	52	May 1 By balance	8500	00
			8 " cash	√√ 3500	00
			10 " E. H. Fasting	√√ 178	52
			" " "	180	00
	12358	52		12358	52
June 3 To cash	√√ 178	50	June 1 By balance	12358	52
6 " "	√√ 180	00	3 " Cash	√√ 655	17
28 " "	√√ 190	56	" " "	√√ 1000	00
27 " Cap a/c	√√ 3750	00	8 " "	√√ 8000	00
30 " balance	17905	19	20 " "	√√ 190	56
	22204	26		22204	25
July 5 To Cash	√√ 200	00	July 1 By balance	17905	19
26 " "	√√ 50	00	5 cash	√√ 3750	00
31 Balance	24405	19	31 "	√√ 3000	00
	24655	19		24655	19
Aug 3 To cash	√√ 3000	00	Aug 1 By balance	24405	19

FRANCIS R. UPTON COLLECTION

1881

X-E6298
1881-01-18

THE EDISON ELECTRIC LIGHT CO.,
8 BROAD STREET.

NORVIN GREEN, Pres.
R. M. GALLAWAY, V. Pres.
E. P. FABBRI, Treas.
C. GODDARD, Sec'y.

New York, Jany 18th 1881

Sold for account of
Francis R Upton Esq
10 Shares Edison E. L. Co Stock
@1050 $10.500
Less Commission 1% 105
$10.395
Cheque herewith

C Goddard

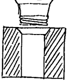
X-E6285-9
1881-8-22

52 Rue La Bruyère
Paris
August 22nd 1881

F. R. Upton Esq
Menlo Park. N.J.

My dear Upton,

Yours received — Thanks for your good wishes — Am sorry to hear of your bad luck when starting up again but that will come all right — there is nothing wants such continual watching as a "finished process for manufacturing anything cheap" and such troubles will only show you that however perfect you may think you have everything you must always be on the look out for some unexpected trouble.
Do you know out of all the lamps that you have sent me only two of the carbons were broken and they were in a barrel that two of the boys saw dropped about 10 feet in Havre — As to the packing it needs no report for all were equally good not a single lamp broken — I find that some of the lamps are left a little large in the plaster body so that they won't go down without breaking up the plaster. I should recommend a hardened steel guage made for all to drop in after turning then we shall be sure the body part is not larger than the thread. I shall send you all the papers. Kindly remember me to Mrs. Upton and tell her we are domiciled at Madame Martin's



Yours truly
Chas Batchelor —

1881. Batchelor in Paris — to Upton

X-E6285-9

Francis R. Upton Esq
Menlo Park
N.J.
Etats Unis d'Amerique

X-E6285-9
1881-11-11

THE EDISON ELECTRIC LIGHT SYSTEM.

EDWD H. JOHNSON,
MANAGER.

57, Holborn Viaduct.

London, E.C. Nov 11th 1881

My Dear Upton -

Yours of Oct 28th at hand - I note what you say about sockets - and have as you of course know promptly telegraphed my disapproval of the means whereby the trouble is proposed to be remedied - It does not meet the case - the ~~eff~~ Evil is in the Plaster & not in the form of the socket - You arrange the socket in what way you please - you will not prevent the plaster from twisting off, in case the slightest sticking occurs in the screw - Nor do you prevent the difficulty of occasional crumbling by reason of moisture &c - The real fact is, I repeat, that plaster is not the proper material for the purpose - and you should promptly recognize this and either go back to wood - or to some plastic material more tenacious than Plaster - It seems to me that such material as will quickly harden in a mould - Even though it be a trifle more expensive than plaster - ought to be found - there are plenty of them if you could apply pressure - but I presume that is out of the question However if they all fail - Wood will do and furthermore it can be arranged as Bergmann once provided - so that the top connection was 3 screws head - thus insuring always a good connection and a perfectly upright position and a very cheap arrangement - we had much better spend a fraction of a cent more than have two standards of sockets ~~to~~ which we

X-E6285-9

2

THE EDISON ELECTRIC LIGHT SYSTEM.

EDWD H. JOHNSON,
MANAGER.

57, Holborn Viaduct.

London, E.C. 188

Should have to supply Lamps in all the future - vide our experience at Hinds & Ketchams - I have sold 1000 Sockets here & shall have to sell a great many more Ere you get rid of your 68.000 Lamps - The Faure Batty people are using our Lamps exclusively now - they want a price on 10.000 per mo commencing January 1st & running regularly through the year - I shall in all probability soon make some other deals in this direction & provide another good source of sale for the Lamps

Meantime I am organizing for my Isolated business which will of course use up a considerable number —

You are welcome to see any & all of my Letters to Edison so far as I am concerned - tell Insull this & he will show you some that will probably interest you -

Your trouble about small orders from the E. L. Co. is only a temporary one When Edison gets his station in action you will get plenty of orders and the gradual growth of the Isolated business as well as the development of new fields - like mine - will enlarge the demands upon you to a paying point -

I am of the Opinion that - if your Experiments are carefully observed - they are wise expenditures - many Eminent men are at work here on the Lamps - Prof Crookes is the

3

X-E6285-9

THE EDISON ELECTRIC LIGHT SYSTEM.

EDWD H. JOHNSON,
MANAGER.

57, Holborn Viaduct,
London, E.C. 188

Last one - with a Carbon - supposed to be made of some kind of thread & said to be so flexible that it may be tied in a hard knot without breaking and that it can be made for a Shilling - nothing said as to its Economy - of course I know nothing whatever of the truth of all this - all I do know is that Every man of these English would-be's - will seek to obtain a Lamp which shall be superior to ours - & I also believe that the margin of improvement possible in the Carbon is still very great - Consequently it is not wise to rest content where we now are -

I telegraphed you to change the 2000 8 candle A's to 2000 B's and ship them along promptly - this will I presume give you a trifle of satisfaction =

I am Entirely too much Engrossed with a multitude of things to afford the time to give you Even a brief sketch of what I am doing - so must refer you to Insull or Edison and will put your name on my Newspaper list so as to give you the public comments on what I am & shall do.

Mrs Johnson returns Compliments to yourself & Mrs Upton - as do I.

Let us hope the time will not be far distant when we want have to Exchange them at such a distance Yours Truly E H Johnson

X-E 62-85-9

THE EDISON LAMP CO.,

1881-12-20

Thos. A. Edison,
Chas. Batchelor,
Francis R. Upton,
Edward H. Johnson.

Menlo Park, N. J., Dec 20th 1881

Major Frank McLaughlin
#65 5th Ave.
New York

Dear Sir,
We have been advised by T. A. Edison Esq. that you have bought one twentieth interest in the property and business of The Edison Lamp Co. We have entered your name on our books and will advise you as to our standing. When you change your address please inform us.

Yours truly
Edison Lamp Co. Francis R. Upton Treas.

I hereby assign and transfer to Francis R. Upton individually all my rights title and interest in and to the within receipt

Frank McLaughlin

X-E62-85-9
1881-12-20

THE EDISON LAMP CO.,

Thos. A. Edison,
Chas. Batchelor,
Francis R. Upton,
Edward H. Johnson.

Menlo Park, N. J., Dec 20th 1881

Received Dividends
Hundred Dollars
less assessment
Edison Lamp
Company
Dividend

Major Frank McLaughlin
~~#~~ ~~Ave.~~
New York

Dear Sir,

As advised by T. A. Edison Esq. We have made an assessment of $10,000.00/100 —
Your share of which is $500.00/100 or 5%. —
We owe about $18,000.- and will have to meet a greater part of it soon. We have about 84,000 good Lamps on hand which we value at $29.400.00/100

Yours Truly
Edison Lamp Co.
Francis R. Upton Treas

I hereby assign and transfer to Francis R. Upton individually all my right, title and interest in and to the within receipt.

Frank McLaughlin

X-E62-85-9
1881-12-30

THE EDISON ELECTRIC LIGHT SYSTEM.

EDWD. H. JOHNSON,
MANAGER.

57, Holborn Viaduct.
London, E.C. Dec. 30th 1881

F.R. Upton Esq.
Menlo Park N.J.

Dear Sir

I have your favors of Dec. 7th and 18th. I like the new socket very much. It is however one that might have been made long ago had we abandoned the switch on the socket; it was the presence of that switch which prevented a better form of socket being made. I see you have abandoned it altogether and I am of opinion that it is wise to do so since there is no form of fixture upon which the switch may not be placed with greater ~~difficulty~~ advantage than on the socket. I do not, however, like the all-plaster socket; it is carrying cheapness to ~~a~~ too great ~~a~~ an extreme. Unless it is considerably modified in form it is not sufficiently durable & will give no end of trouble. I notice what you say in regard to the improvements Edison is making in the lamps but your second letter does not seem to carry out the expectations of your first, namely, that that improvement would give to the ten per C.H.P. lamps a life of from 3000 to 4000 hours.

 X-E6285-9

Whether ~~he~~ it does or does not is however not of so much importance as that it has raised the life from the low limits of my present lamps to the more practical limit of 1000 hours. I am of course sorry that the lamp factory is not yet a paying institution but it must be borne in mind that we never contemplated that it would pay until Edison had at least one station started. That that station has been delayed for some months yet we must accept & bear the consequence as best we can. The Faure battery concern is at ~~thistle~~ fizzle; it has played out in France and has played out here. It is now denominated as the "rotten battery" in as much as the felt rots and the batteries are so short-lived as to make their first cost an impassable barrier to their general use I happily got my money out of the concern and have nothing further to do with it. I am of the opinion that they will shortly close up shop here in London; consequently we must not look to them for the realization of any of the great expectations held out by their bombastic proposals. I have heard of Holzer's marriage. All I have to say is that I congratulate Alice.

Your second letter of Dec. 18th — I am much obliged for your attention to the suggestions as to 100-candle lamps

and soforth; we do not want them for street lighting but do want them for some tests at the Crystal Palace. I notice what you say in regard to life tests and will remember it when we come to that branch of our work. I am sorry after your elaborate explanations as to how you could make an economical lamp for the Faure battery that the Faure battery is not in a better financial position. I can give you however some consoling news; it is this - the Faure battery has served the purpose of a forerunner. Biggs of the Electrician with some unknowns ~~an~~ backed by John Pender ~~&c~~ of cable fame is bringing out a battery which he (Biggs) told me will have "Four" times the efficiency of the Faure battery and which will not rot inasmuch as no felt is used, metals being substituted. Biggs assures me that sufficient has been done to absolutely demonstrate these facts; your letter to me will be exceedingly valuable in view of this. I am personally acquainted and on dining terms with John Pender and he has been good enough to say on more than one occasion that he places great confidence in my judgment and I am specially retained by him for the purpose of passing upon the efficiency of Biggs battery when it comes out. Now I shall make use of your letter with

X-E6285-9

Pender in order to anticipate their wants in case their Battery is a Success. So you see no harm has been done by giving your attention to the subject.

I will make it a point to interview these parties immediately on the subject as it is some weeks since I saw Biggs and learn what the prospect of an early solution of their problem is. If I find that there is a strong probability of its immediately appearing I will at once advise you and you had better make some Lamps and send them to me so that they may appear coincident with the Battery. It would be a good thing of course to be able to start in conjunction with this thing.

Mrs Johnson joins me in regards to yourself and Mrs Upton.

I am, Dear Upton,
Very truly Yours,
Edwd H. Johnson

FRANCIS R. UPTON COLLECTION

1882

X-E62-859
1882-05-02

THE EDISON ELECTRIC LIGHT SYSTEM.

EDWD H. JOHNSON,
MANAGER.

57, Holborn Viaduct.
London, E.C. May 2nd 1882

Francis R. Upton Esqre.
Edison Lamp Factory,
Menlo Park,
New Jersey.

My dear Upton,

Your various favors have been duly received and all you say about Lamps of different Candle power; Faure Battery; 10 Candle high resistance 32 Candle; 50 Candle A Lamps &c all duly noted. I will not answer your questions in detail as that would occupy too much time and would probably be to less purpose than to generalize them. First, you seem to be under the impression that the Companies should do something to assist the Lamp Factory in its experimentation. This is wrong. The only way that such assistance can be had is to obtain from them large orders for Lamps which have passed beyond the stage of experimentation and a price therefor which will not only leave a fair margin of profit but a little extra which you could credit to the experimental account. I think in getting 50 cents for the Standard Lamps you have this margin and you have practically what

you ask for. Our want is, Lamps of greater candle power for Streets and large open spaces. It is not sufficient to put a number of Lamps in the open air as you would put a number of Lamps in a Room. In a room you can place these Lamps in a multitude of places with little or no expense but in the Street you are necessarily limited to the number of places that you can put the Lamps. True you can put a number of them in a single Street Globe but while the product of light may be precisely the same the effect is vastly different. If you have two Lamps of 16 Candles each in one street lamp and one Lamp of 32 candles in another, 99 out of 100 will vote that the single Lamp yields the greater volume of light; besides being more symmetrical. I am speaking from experience and not upon theory. I should like above all things to have a practical 50 Candle Lamp. With such Lamp I am satisfied that I could successfully compete not only with gas but with arc lights for Street illuminations. Now here is the point. I hold that it is to your interest to spend a certain amount of money and time and energy in perfecting this Lamp as speedily as possible. In England the successful lighting

of the Streets is made a criterion for the adoption of a System by the Lighting authorities and that System which will first successfully and practically light the Streets by incandescence will receive the approbation of the powers that be in all the Towns and Boroughs of Great Britain. There is no use of kicking against the pricks; it would be far wiser to conform to the views of other people in cases where they are not radically wrong and thus to make progress in respect to advancing our other and far more important interests, namely, those of lighting interiors. I therefore pass judgment most decisively on this question that it is of vital importance that you produce a 50 Candle Lamp at the earliest possible moment. One 50 in each Street Lamp on the Holborn Viaduct will give greater satisfaction and bring to us greater eclat than 2, 32's in the same Lamp as one 32 undoubtedly does as against two 16 lamps. The disadvantage of the extinguishment of the Light in the Street Lamp by the death of the single Lamp contained therein is a trifling one inasmuch as it is but for a very brief time, daily inspection being the rule. A saving is effected of course in the necessity for providing but one Socket instead of two. As to Faure Battery Lamps

I should be glad to receive some of more practical utility than the very low candle power lamps you have already sent; they are not of much value but those you describe I fancy would be a very saleable article and I should like to have them but they are all of infinitely less importance than the higher Candle power Lamp. The 32's I have appear to be all black in the Globe when they come to me. You should at least be able to supply us with Lamps not blackened in the process of manufacture. At present I am using some 32 and some 16. The effect is not symmetrical, nevertheless the appearance of the Viaduct with nothing but incandescent lights in sight on either side of the Street and in the shops is very beautiful and I wish you could all see it. You will of course have learned long before this of the considerable order I have transmitted to Mr. Edison for Lamps and machinery. I am quite satisfied that this Order will be supplemented long before it is half filled with other orders fully as large if not greater. I am particularly pleased with the cylindrical form of glass for the Lamp. I think it is the correct form, and as all parties here agree with me our order has been made for that style of Lamp alone. I have noticed that in the one or two which you have sent me the blackening has been at the top rather than down at the clamps.

5 This is a decided advantage. The blackening X-E6285-9
is so diffused that it is longer in becoming apparent and when at its greatest is not so apparent as in the old form. I notice, however, that the glass is very imperfect; if you would use the same quality and clearness of glass that you have in the other form I think these Lamps would be exceedingly attractive. Please exercise some little care in this respect for you must always remember that here in England we have to contend with several other manufacturers all of whom are aiming (especially Swann) to produce an artistic appearance while we seem to ignore anything like taste in our productions. This is especially so in the clumsy manner in which the Lamp is fixed in the socket. In the first place the socket is made unnecessarily long by the projection of the insulating piece from the top and the Lamp does not even go down flush with this. The result is an awkward union between the two which is unsightly in the extreme. If noone gives attention to this matter before I return I propose to make it my especial business to do so but I would like to have it receive attention so that the 30,000 or 40000 Lamps which I have ordered and the sockets therefor may form a more graceful whole than the present combination.

X-E6285-9

I should like to give you some notion as to the Crystal Palace and Viaduct Installations but I have not the time. Suffice it to say that both continue to work without the least hitch or failure; the one from 6.30 to 10 every Evening and the other from 6.30 p.m to 6 a.m. The machines work very smoothly and in fact they are a complete success in every respect.

Kind regards to Mrs Upton in which Mrs J. joins me.

Very truly Yours
Edwd H. Johnson
per Geo. Hayes.

Mr Johnson is not here to sign this Letter. His Lecture on the Edison System of Electric Lighting comes off at the Crystal Palace tomorrow Evening and is looked forward to with considerable interest. I have to report it verbatim. G.H.

X-E62-85-9
(1882)

The Edison Electric Light Company

65 Fifth Avenue

New York November 6th, 188

Francis R. Upton, Esq.

Harrison, N. J.

Dear Sir:-

You may be interested in reading the enclosed letter which I have just sent to each of our directors. Let me suggest that you come into the meeting. You are not a director but you are a large stockholder and to all intents and purposes are a director. If you feel interest enough kindly come into the meeting just as if you were a director.

Very truly yours,

S B Eaton

President.

X-E6298

~~Book 22 Prof~~

Probably April – May 1879 Book 22 Page 51

Sketch "Sun flower" regulator for electric light.

Probably Feb. Mch 1879 Book 23 Page 92 —

Weber – Ohm – Minute worked out

Jan 5 1880 Book 24 Page 150 – 151

Sketch ~~of~~ & dimension of dynamos # 5, 6, 7, 8, 9, 10

Feb. Mch 1879 Book 26 Page 94 – 100

Analogy between cells and motors worked out showing effect counter E. M. F.

Book 25 missing. see Book 26 Page 217

Book 26 Page 168 – 169

Probably May – June 1879 Sketch showing table with wheel connecting to resistance boxes.

Probably July 1879 Book 26 Page 227

Proof that meter shows total work done whether on motors or lamps

July 7. 1879. Book 28 Page 163

Test of dynamo with dynamometer.

Fall 1879 Book 28 Page 199

Account of high resistance Gal used both to measure E. M. F. and current

April 1879 Book 8 Page. 17 – 35

Discussion of value of "Weber".

X-E6298

~~May~~ June 1879 Book 8 ~~pages~~
Many measurements of output of dynamo machines. Used ~~do~~ electric dynamometer containing mercury
Book #31 Page 227 no date probably July-Aug 1879
Connection shown which shows when traced shows resistance in series with motor
1879 Book 31 Pages 94 —
1880 33 " 132 —
No. of turns of wire of various sizes required to make an Ohm on magnet.
~~July~~ 7, 1879 Book 37 Pages 45
Rough draft letter Mr. E and Fran to "Engineering" about ~~standard~~ test made by Hopkinson of Siemen's machine.
May 1880 Book 37 Page 153
Some figures regarding armature of Edison machine
Book 37 Page 171
~~Proff~~ Proof that maximum of work from motor is greatest when C.E.M.F. is 1/2 of E.M.F of dynamo
June 23 1880 Book 39 Page 185
Test of small motor with Prony
12 Ohms mentioned as placed in line with magnet.

[2]

May 13, 1880 Book 51 Page 163 - X-E6298

Mr. Batchelor Elec RR. figuring on eccentric

Dec 5, 1879 Book 52 Page 195

~~Ad~~ Mention of running sewing machine at Edison House in connection with lamps

1879-1880 Book 59 Page 249—

Calculations on motors

July 1, 18~~77~~ 79 Book 77 Page 159 &c

Test of Edison dynamo with dynamometer

Sept 5 1879 Book 77 Page 268-280

Tests of sewing machine motor showing that resistance of 6.2 ohms was introduced into circuit

April 16, 1880 Book 80 Page 157-159

Sketch reverser

May 20, 1880 Book 80 Page 179

Memorandum estimate of cost elec road

Book 81 Missing

April 2, 1880 Book 82 Page 12-23

Tests of Edison dynamometer and Prony

April 7 or 8 Book 82 Page 83-85

Tests of various individuals turning Sewing Machine Motor as dynamo.

~~May~~ April 19, 1880 Pages 209 Book 82

Lamps for Columbia mentioned

July 13, 1880 Book 103 Page 113 X-62-98

Test of insulation of R.R.

July 3, 1880 Book 108

Various uses of motor enumerated by Mr. E

Aug. 3, 1880 Book 135 Page 12

Third rail shown

Book 135 Page 15 in Edisons hand writing

"Mention if not already shown auxilliary coil on field".

Page 16 —

"Mention that train can be braked by opening ckt. to bobbin and short ckty. it" &c

Feb. 12, 1882 Book 249 Page 1

Hughes says "Two separate coils round the magnets one of 1.7 Ohms resistance the ~~other~~ other 10 Ohms both in multiple arc. The larger coil to be used for starting and the 10 Ohm coil after getting under way and the large coil cut out entirely".

April 12 1882 Book 249 Page 31

"Worked all day hauling ties and gravel armature not heated".

[ON BACK OF PRECEDING PAGE]

Large wire
About 8 1/2 convolutions
to an inch

about 24 inches to
convolution

16. inches
6 1/2
8
96
104 convolutions

208' ft. No 8?

Axle turned down at place
where large wire is wound

Small wire

Length core 3'

Length over all about 4' 6"

Around lower leg of mag-
net where no wire had
been removed 23"

Around upper leg where there
are 4 layers of wire
20 3/8"
Around upper with three layers
20 1/16"

Oct 31, 1880 X-6298.

Book 60 Page 38

Device shown for regulating sewing machine speed by throwing in resistance with the foot.

Book 60 Page 27 Oct 31. 1880

Show cutting out field magnet wire by means of a governor

Book 60 Page 24 Oct 31. 1880

Resistance introduced into motor circuit by governor.

[5]

X-E6285-9

THE EDISON LAMP CO., (1882)

Thos. A. Edison,
Chas. Batchelor,
Francis R. Upton,
Edward H. Johnson.

1

Menlo Park, N. J., ... 188

Regarding the danger from fire in Electric Lighting

The newspapers have lately spoken concerning ~~spoken~~ of the danger ~~from~~ of fire from electric lights and from ~~from~~ the ~~str~~ currents supplying ~~lighting~~ them. ~~In several instances~~ telephones have been made to smoke and even to burn from the ~~t~~ wires leading to them coming in contact with ~~the~~ those ~~wires~~ carrying electricity ~~to~~ ~~arc lights in~~ ~~one~~ ~~or~~ for lighting purposes.

~~Electricity~~ Electricity has ~~Its~~ very ~~precise methods~~ of showing itself and doing

2

X-E6285-9

There have been several instances where telephones and fire alarm boxes have smoked and even as ~~taken fire when the wires leading to them have come in contact with the wires~~ taken fire somewhat in the manner of ~~like a~~ the carbon in the electric light.

The ~~t~~ wires ~~were~~ leading to these telephones had come in contact with those carrying electricity for ~~electric~~ lighting purposes.

Electricity has very precise methods of showing itself and doing its work. It is capable of being brought very easily

under control, since as a heat carrier ~~then~~ And there are only three elements to be considered. These elements are 1st: the tension under which the electricity is driven 2d: the amount of electricity passing ~~and~~ and 3rd: the specific power of the circuit to absorb and radiate the heat current carried by the electricity. ~~Therefore~~ under ~~the~~ greater the tension the electricity is more active ~~the electricity is finding ways of its own~~ and to go astray from its own given circuit.

The ~~Under~~ the greater tension the more active the electricity in leaving the circuit through which it is passing and seeking a new one. Under such circumstances the heat carried by the electricity is also corresponding greater — Mr. Edisons lamp is an ~~[illegible]~~ example of the specific power of the circuit to absorb and radiate the heat carried by the electrical current. ~~[illegible]~~ The carbon placed in the ~~a~~ glass globe has this specific power to such an extent that when an sufficient electrical cur-

rent is made to
pass through it a
large amount of heat
is given off and being
concentrated on a small
~~amount~~ surface in a vacuum takes
the form of light.

In a telephone box we
find a certain resemblance
to Mr. Edison's lamp in that
~~through coiled like wire~~
~~coiled like spools is~~ electricity
under tension is made
to pass through wire,
~~coiled upon spools~~
~~and heat is given off~~
~~from these small~~ having
the specific power to absorb
and radiate heat from the
electricity

6 These wires are coiled upon
small spools and if the
~~th~~ tension of the electricity
which is passing through
then be high the heat given
off will be very great enough
in some ins to ~~cause~~ ignite the wood
work of the box. ‡

Throughout New
York there are many
hundred of these lamp-
like telephones for
such they are electrically
speaking. ~~only these~~ ~~only~~
~~need a slight~~ ~~Already~~
~~needs a slight~~ If by
chance a high tension circuit filled with Elec under comes
in contact with the
wires leading to the telephone
this is to ~~set these on~~ ~~set~~

heat or set them on fire."

"Anyone that has ever noticed the masses of wires ~~that lead to the~~ In New York today the wires leading to the telephones ~~may~~ are ~~be~~ counted by the thousands, as they stretch across the house tops and along the poles lines. the chances for ~~[illegible]~~ new lines to be placed without interfering with the old is small. Yet ~~light~~ lines ~~[illegible]~~ supplying electric lights are now run among this net work. The only wonder is that there

are so few instances of trouble and almost none of serious fire. ~~The~~ The telephone companies have seen the danger and ~~have~~ ~~[illegible]~~ are now placing devices on each telephone to prevent any undue amount of electricity from flowing through them.

The danger ~~thus mentioned~~ is entirely done away with in Mr. Edison's system. His main wires ~~[illegible]~~ run underground, ~~he will also [illegible] his lamps with [illegible]~~ he uses low tension electricity and runs two wires ~~across both of which~~ to complete the circuit so that a telephone would have to make contact

X-E61-8E-9

contact takes place heat
is given off exactly the
same as if a lamp on
Mr. Edison's system should
have been lighted..

In every case the wires of
the telephone will be found
stretching over the streets while
even on the same poles or
crossing them will be found
the wires of the electric lights.
carrying electricity of under
terrible tension and ready
for any chance to take
a short cut to the ground

-- Mr. Edison has a system
of distributing heat centres by
means of two wires

FRANCIS R. UPTON COLLECTION

1883

Memoranda of entries to a/c of F. R. Upton
From April 27. 1882 to date

Dr.		Cr.
	April 27. 5% of $35000.00 recd from Drexel Morgan & Co a/c English Electric Light	1750.00
	May 11. 5% of $6000.00 recd from D. M. & Co (by payment of Lamp Co Note) on a/c English Light	300.00
	Dec. 30. Balance due on English Light	93.63
	" 30 5% proceeds of sale of Indian and Australian Light after deducting 1/3 of 85% of same due Porter Lowrey Soren & Stone	1340.16
1500.00	April 27. Check	
1098.00	Dec. 30. Subscription to 45 shares of Edison Ind & Col. Light Co. stock at 5£ each exchange 4.88 (stock not delivered	
3.66	Dec 30- 5% of expenses in connection with Ind & Australian Light	
882.13	To balance down	
3483.79		3483.79
	Balance down	882.13

E & O. E.
8th March 1883
Saml Insull

Mr Upton is also entitled to five per cent of the shares of the Edisons Indian & Colonial Electric Co which are due (net) to Mr Edison from the Edison Electric Light Co Limited England S.I.

EDISON LAMP COMPANY.

THOMAS A. EDISON, PRESIDENT,
FRANCIS R. UPTON, TREASURER.

X-E6285-9
1883-10-06

East Newark, N. J., Oct. 6 1883.

Dear Mr. Edison:

I call attention to the following facts.

A careful statement sent you on July 2, of our financial work for the previous six months, showed that the Lamp Co. had made a profit of \$24,628.84 during the six months. ~~pass~~

Since July 2 to Oct. 2 we have also made money though we have only sold \$29.383.79/100 worth of lamps.

We owed outside parties on

July 1	\$33.173.14
Oct 1	29.687.81
	3.485.33

That is we have decreased our liabilities to every one except the money due on my loan and the mortgage. \$3.485.32

EDISON LAMP COMPANY.

THOMAS A. EDISON, PRESIDENT,
FRANCIS R. UPTON, TREASURER.

X-E6285-9
1883-10-06
E. 2

East Newark, N. J., 188

My loan has increased	\$241.07
	3485.32
leaving net gain	\$241.07
	3.244.25

Bills due us Oct. 1	\$22.708.70
" " " July 1	14.357.96
Gain.	8.350.74

Total ~~Bain~~

Decrease liabilities	3.244.25
Increase assets	8.350.74
Better off Oct. 1 than July	\$11.594.99

This of course is ~~due~~ largely money realized on the sale of stock on hand. Yet after making every allowance about \$3.000.00 we have made money in the last three months.

The orders now on hand will bring us over \$11.000 more ~~from~~ sale of lamps in stock

X-E6285-9
1883-10-06 E. 3

EDISON LAMP COMPANY.

THOMAS A. EDISON, PRESIDENT,
FRANCIS R. UPTON, TREASURER.

EAST NEWARK, N. J., ______ 188

Conclusion —

I think the Lamp Co. should now pay me a salary. It is making money, and my pay will come from the profit of the business. I have been here without salary nearly three years.

I have given my entire time to the interests of the concern. I have done everything in my power to help the Lamp Co. financially, often at a sacrifice.

I value my services at $500 a month. I am 31 years old and have served you for five years, I know faithfully, with the understanding that you would be liberal when my salary could be taken from the profits of the business.

Yours Truly
Francis R. Upton

BILL OF SALE. W. Reid Gould, Law Blank Publisher and Stationer, 168 Nassau St. N. Y.

Know all Men by these Presents, That

I Frank McLaughlin, of the City of Newark, County of Essex and State of New Jersey

of the first part, for and in consideration of the sum of Twelve thousand five hundred dollars — lawful money of the United States, to me in hand paid, at or before the ensealing and delivery of these presents by Francis R Upton, of Orange New Jersey —

of the second part, the receipt whereof is hereby acknowledged have bargained and sold, and by these presents do grant and convey unto the said part of the second part, his executors, administrators and assigns all my right, title and interest in and to the property of the so-called Edison Lamp Company, of Harrison New Jersey, and the appurtenances thereof, of every name and nature; also any Choses in action Claims, debts, dues and demands now owing to said so-called Edison Lamp Company —

To have and to hold the same unto the said party of the second part, his executors, administrators and assigns for ever. And I do for myself my heirs, executors and administrators, covenant and agree, to and with the said party of the second part, to warrant and defend the sale of the said above described property hereby sold unto the said party of the second part his executors, administrators and assigns, against all and every person and persons whomsoever.

In Witness whereof, I have hereunto set my hand and seal the first day of November in the year one thousand eight hundred and Eighty-Three

Sealed and delivered in the presence of

Albert T. Moore

Frank McLaughlin

BILL OF SALE.

Frank McLaughlin

TO

Francis R Upton.

Dated 18

X-E 6298

1883-11-01

State of New York
City &
County of New York } ss.

On the first day of November in the year one thousand eight hundred and eighty-three before me personally came

Frank McLoughlin

to me known, and known to me to be the individual described in, and who executed the foregoing instrument, and acknowledged that he executed the same.

Albert T. Moore
Notary Public appointed for and residing in the county of Kings & qualified to take acknowledgments in the City & County of New York.

X-E6298
1883-11-01

Frank McLoughlin

To

Francis R. Upton

Assignment

W. J. Curtis
with SULLIVAN & CROMWELL.

Counsellors at Law,
DREXEL BUILDING, WALL STREET,
NEW YORK.

Know all men by these presents that I, Frank McLaughlin of Newark, New Jersey for and in consideration of the sum of Twelve thousand five hundred dollars lawful money of the United States to me in hand paid, at or before the ensealing and delivery of these presents by Francis R. Upton of Orange New Jersey, the receipt whereof is hereby acknowledged have assigned, transferred and set over, and do by these presents assign, transfer and set over to said Francis R. Upton, his Executors Administrators and assigns all my right title and interest in and to the business, property, good-will, and contracts owned or controlled by the so-called Edison Lamp Company, of Harrison New Jersey, or the individuals composing said Company; also all my right, title and interest in and to any and all claims, debts, dues or demands now due or to grow due to said Company, and any share or interest that I may or can have in and to said business property, good-will, contracts, debts, dues or demands, whatever the same now appears or may hereafter appear to be, and I hereby relinquish and release to said Upton all claim or right that I now have against or upon said Edison Lamp Company or the individuals composing the same, and I hereby grant to said Upton full power, right and authority to take any steps that may be necessary or advisable to vest in him a full, complete and indefeasible title in and to all my property

and interests in said Edison Lamp Company
To have and to hold the same to the said Upton,
his Executors and administrators and assigns
for ever. This assignment shall bind my
Executors, administrators and heirs

In witness whereof I have hereunto set
my hand and seal the first day of November
in the year one thousand Eight hundred and
Eighty-three.

Frank McLaughlin

Sealed and delivered
in the presence of }
"his Executors, Administrators
and assigns"
interlined on first page.
before execution.

Albert J. Moore

State of New York
City and County of New York } ss:

On this first day of November
1883, before me personally appeared Frank
McLaughlin to me known and known to
me to be the individual described in and
who executed the foregoing instrument,
and acknowledged to me that he executed
the same.

Albert J. Moore

Notary Public appointed for
and residing in Kings County
& qualified to take acknowledgments in the City & County
of New York.

X-E 63-98
1883-11-01

Frank McLoughlin and
Margaret, his wife

To

Francis R. Upton.

Quit-Claim Deed.

Dated Nov^r 1^st 1883.

Wm J. Curtis
Attorney & Counselor
3 Broad St.
N.Y.

QUIT CLAIM DEED. W. Reid Gould, Law Blank Publisher and Stationer, 108 Nassau St., N. Y.

This Indenture,

made the first day of November in the year one thousand eight hundred and Eighty-three **Between** Frank McLoughlin and Margaret McLoughlin, his wife, of Newark, Essex County, New Jersey, parties of the first part and Francis R. Upton, of Orange in said County and State

of the second part, **Witnesseth,** That the said parties of the first part, for and in consideration of the sum of One dollar -

lawful money of the United States of America, to us in hand paid, by the said party of the second part, at or before the ensealing and delivery of these presents, the receipt whereof is hereby acknowledged, have remised, released and quitclaimed, and by these presents do remise, release and quitclaim, unto the said party of the second part, and to his heirs and assigns forever, **All** our right title and interest in and to the lands and premises now owned by the Edison Lamp Company or the individuals composing the same, and situate in the Township of Harrison, County of Hudson and State of New Jersey, and lying between Bergen and Sussex Sts. being the same property formerly owned by the so called Peters manufacturing Company.

A.C.M.

Together with all and singular the tenements, hereditaments and appurtenances thereunto belonging, or in any wise appertaining, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof. **And also,** all the estate, right, title, interest dower, right of dower, property, possession, claim and demand whatsoever, as well in law as in equity, of the said parties of the first part, of, in, or to the above described premises, and every part and parcel thereof, with the appurtenances. **To have and to hold** all and singular the above mentioned and described premises, together with the appurtenances, unto the said party of the second part, his heirs and assigns, for ever.

In Witness whereof the said parties of the first part, have hereunto set their hands and seals the day and year first above written.

Sealed and delivered in the presence of

Albert C. Moore

The word "Hudson" written over an erasure before execution hereof.

Albert C. Moore

Frank McLoughlin [L.S.]

Margaret McLaughlin [L.S.]

State of ____________ }
______ of ____________ } ss.
County of ____________ }

On the ________ day of ________ in the year one thousand eight hundred and ________ before me personally came ________

to be the individual described in, and who executed the foregoing instrument, and ________ acknowledged that he executed the same.

State of New York
City and County of New York } ss:

Be it remembered that on this first day of November in the year of our Lord one thousand eight hundred and eighty-three, before me, Albert T. Moore, a Notary Public in and for said State, duly commissioned and sworn, and residing in the County of Kings in said State, and qualified to take acknowledgments in the City and County of New York, personally appeared Frank McLoughlin, who, I am satisfied, is one of the grantors mentioned in the within Indenture, and to whom I first made known the contents thereof, and thereupon, he acknowledged that he signed, sealed and delivered the same as his voluntary act and deed for the uses and purposes therein expressed.

Albert T. Moore
Notary Public appointed in and for Kings County, and qualified to ~~admi~~ take acknowledgments in the City & County of New York.

~~State of
County of } ss:~~

~~Be it remembered that on this
day of November, in the year of our Lord, one thousand eight hundred and eighty-three, before me,~~

~~personally appeared Margaret McLoughlin,~~

~~who, I am satisfied, is the wife of Frank McLoughlin, who signed, sealed and delivered the within Indenture, and is one of the grantors mentioned in the within Indenture; and the said Margaret McLoughlin, being by me privately examined, separate and apart from her husband, acknowledged that she signed, sealed and delivered the same as her voluntary act and deed, freely, without any fear, threats, or compulsion of her said husband.~~

State of New Jersey }
County of Essex } ss. Be it Remembered that on this First day of November in the year of our Lord one thousand Eight hundred and eighty three before me a Master in Chancery of New Jersey personally appeared Frank McLaughlin and Margaret McLaughlin his wife who I am satisfied are the grantors in the within deed of conveyance named and I having first made known to them the contents thereof, they acknowledged that they signed, sealed and delivered the same as their voluntary act and deed for the uses and purposes therein expressed.
And the said Margaret McLaughlin being by me privately examined separate and apart from her said husband further acknowledged that she signed, sealed and delivered the same as her voluntary act and deed, freely without any fear, threats or compulsion of her said husband.

Alan M.C. Morrow
Master in Chancery of
New Jersey

FRANCIS R. UPTON COLLECTION

1884

#40 E-6124 140

The children are all well and send [illegible] love Curtis has [illegible] [illegible] [illegible] Much [illegible] Mother [illegible] [illegible] [illegible] [illegible] Frank sends his love and [illegible] [illegible] to you all.

very long time since we have heard from either you or your Mother. and so I haven't written for some time, as I loose my impulse when I don't receive letters.

A great deal has taken place in this family since you last heard from us. the much looked on and waited for event of buying a house and home. which Frank bought it. I have had so many misgivings about the size of the house, the location &c &c that at times I have been quite unhappy. as I feared it was too large and the expense

if she has sold any thing more she thinks she is dead set[illegible] but Frank has a salary from the Lamp Co of three thousand dollars which I think is most lovely. but which he thinks is about half as big as he considers himself worth. so that will help us out. I tell Frank it seems as if he had too much the salary, and house both in the same year!

Our house is right in the town really on the same street as the depot. and you have found things rather of a disagreeable neighborhood. but it is so hard to get any thing and you really can't. We pay fifteen thousand dollars for the house. half down and the rest our estate give the mortgage and I am to pay it off with my income. so it will be my house. Frank gave me money for it once [illegible] [illegible]. but has since presumed [illegible] Mother has been sick in bed for the past week but is better today [illegible] [illegible] she has

[illegible] [illegible] been taken [illegible] [illegible] in [illegible] being. but I hope it will [illegible] [illegible] [illegible] [illegible]

would be worse than he ought to carry. but Frank thinks he can afford it. and tries to make me think that it is all right. and I think so. only I don't want Frank to feel that I am pushing him and a thousand other things. but I guess every one has misgivings when they take any important step. Frank says it was just the same when he wanted to be engaged and married I put it off and was afraid it was not time. and he had to say the word and decide, and now he will do the same and decide. and then after he get in if he find it too expensive he can move out. but I am going on and telling you of all

our tables and my foolishness and weak mindedness, and I must tell you about the house. it is an old fashioned square house with a long ell. a real New England house. but will be comfortable and just lovely. and is one that will furnish handsomely and grandly (in time) we are just going to move in, as it is, and with what we have. and leave what we want of painting &c for the future. doing a little at a time, the grounds about the place have some beautiful large trees and it will be a lovely place for the children to play. there is a nice stable. but we shan't keep a horse at present. I shall have to hire another servant a real waitress. and second girl, as you know Mary is as slow as molasses. and Frank said just so. and just as she has done and

X-E6285-9
1884-01-29

New York, January 29th, 1884.

Francis R Upton Esq
DIRECTOR.

Dear Sir:

The Edison system of lighting has been for a year past an accomplished, practical, working fact, but the financial results, as shown by the balance sheets of the three Companies, are disappointing, if not disheartening.

In my opinion we are drifting toward destruction.

More money will be required, and in the present state of public feeling Stockholders will not respond to our calls on a mere promise of large dividends at some indefinite period in the future.

Now that we have, so to speak, passed the experimental period and are on an established working basis, it is our duty as Directors and Officers to so manage the business that the best financial results shall be secured for the Stockholders.

Whilst I am not willing to assent to any niggardly policy, I must insist on proper economy, and a wiping out of all interests that, in the nature of things, are antagonistic to the best welfare of the several companies.

With these explanations I submit the following suggestions for the purpose of bringing out a general discussion and expression of opinion as to what is best for us to do to develop the Edison System, and place it where it ought to be, a blessing to mankind, and a profit to those who, in their confidence in Mr. Edison, have so freely and liberally advanced their moneys to enable him to elaborate and complete his wonderful inventions.

I beg you to understand that, feeling the necessity that something should be done, I give these suggestions merely as an initial or starting point, or in other words to open up the subject.

The Junior Companies have practically lived up to their agreements with the Parent Company, whilst it, so far as I can learn, has never taken any steps towards protecting them in the rights for which they paid so heavily. On asking the reason, I am told it will cost $300,000 and take years of time. Further, that opposition Light Companies make no secret of using our patents, and boast they will continue to do so whenever they can make them available.

To merge these differences I suggest to consolidate into a new Company, at about present market value, say COMPANY (give it a short name), Paid-up Capital $3,120,000, with privilege of increasing to $,000,000, divided as follows:

Light Company,	*$1,080,000, at 1½ new shares for each old share,*	*$1,620,000*
Isolated,	*1,000,000, at share for share, - - - -*	*1,000,000*
Illuminating,	*1,000,000, at 1 new share for 2 old ones, - -*	*500,000*
	Total, - - - - - - - -	*$3,120,000*

Calling up unpaid instalments on old shares will give us money for our wants for some time. As the Parent Company now has in its treasury a large amount of Isolated and Illuminating Shares, the exchange of these into new stock will leave in the new treasury some $800,000 of stock

X-E6285-9
1884-01-29

which could be used in building one or more new stations up town, and in buying out the present manufacturing companies, besides leaving a surplus in the treasury.

Make a new contract with Mr. Edison equitable and just to all parties. I am confident that gentleman will treat in a most generous manner the claims of those (the Stockholders) who, through their implicit confidence in him, have advanced nearly two millions of dollars to enable him to make very costly experiments, and thereby complete his inventions through which he has earned and gained an imperishable fame.

All outside manufacturing companies controlled by any of our own people should, on a fair basis, be brought into the new Company. In the nature of things their interests are antagonistic to ours. It is only human for them to strive for the largest profit practicable, leaving the smallest for us. At all events they will be charged with doing so even if they work without profit.

As a matter of fact public opinion is becoming aroused to this very thing in other corporations, and I do not believe our Stockholders will hold us harmless unless we make some change in respect to this. So far, under force of circumstances beyond our control, we are fully justified in all that has been done in this manufacturing business. There has not been any wrong in it. It was an absolute necessity for the proper development of the system, but the time is at hand for us to take measures for a general reorganization of all these matters.

The cost of introducing the light into buildings must be materially reduced; there is not any valid reason why the plainest and most simple wiring should cost three or four times as much as gas piping for similar service. To do this the business should be thrown open to competition, giving any one the right to wire and supply fixtures, provided he complies with the rules of the Board of Fire Underwriters. Any royalty we may make out of the present system is more than lost in the detriment to our business through enhanced cost to customers.

My faith in the Edison Light is stronger than ever, but to make it a financial success it must be supplied at a price, every thing included, reasonable enough to make it available for the masses.

I believe it can be done.

As we are going on now we shall be worse off financially at the end of the year than we are to-day, but if we can arrange to re-organize our business, take advantage of the hard times to build and install two stations uptown at a reasonable cost to the Company and to the consumer, we will have done a great deal towards bringing the market value of our Stockholders' property, much nearer than it is to-day, to what I believe to be its intrinsic value.

In closing I beg to repeat these suggestions are merely given as an initial or starting point for something better, and are conveyed to you in this manner, rather than verbally at a meeting, for the purpose of giving ample time for the investigation and thought that is necessary for such an important matter, as any radical change should only be made after a mature, careful consideration and interchange of views.

Respectfully,

Anthony J Thomas

X-E 62-81-9 (1884-01-30)

THE EDISON LAMP CO.,

East Newark, N. J., ...188

Notes on Mr. Thomas' letter to the directors of the Edison Cos.

"Disheartening results."

During the past year the ~~to~~ Edison Light Co. have closed contracts for the ~~erection~~ of stations ~~eating the contractor~~ amounting to $ 328.070 exclusive of land and in several instances of buildings. Active inquiries have been made from cities that will take $1,037,007 worth of work.

During the ~~past~~ year 1883, the most marked progress has been made ~~in~~ ~~fa~~ by new inventions of Mr. Edison. The cost for lamps of dynamo machines has been reduced one third and the mechanical efficiency increased.

All the appliances that enter into an electric light plant have shown Mr. Edison's inventive genius to a marked

X-E63-85-9
(1884-01-29) 2

THE EDISON LAMP CO.,

East Newark, N. J., ... 188

degree. For example, the three wire system together with the improvements in making a high resistance lamps, will allow a station similar to the one at Pearl ~~St.~~ street. to be run with one fifth of the copper per lamps that was required in the installation of that station.

"~~Def~~ Drifting towards destruction"

During the past year the Isolated Co. have made a small dividend in spite of the great dullness among textile manufactures. The Illuminating Co. have turned the corner, and are now receiving from regular sales of ~~lamps~~ light about twice the cost of making the light.

The Light Co. have taken in stocks ~~and~~ worth par and cash over $100,000 from various sources. ~~which is in reality~~ ~~an~~ The various sub-Cos. are feeling that that they have done well in taking hold of Edison light.

X-E6285-9
(1884-01-29) 3

THE EDISON LAMP CO.,

East Newark, N. J., ... 188

"More money will be required"

Yes, but for investments that will pay well on money invested.

Regarding patents.

Those ~~that~~, who are best informed, state that Mr. Edison has a clear case, on the patents allready granted him, to hold the field of incandescent lighting. The same point that has been recently decided in Germany will come up in this country and there is no reason to doubt but that the decision will be the same, sustaining completely Mr. Edison's claims as inventor of ~~[illegible]~~ the only successful incandescent lighting.

Regarding the consolidation of interests.

The Edison Co. started with a definite policy to be a patent-owning ~~to~~ company, simply, and to hold stock in sub-companies ~~to~~ representing its patents-rights. That this policy has been a good one, events have shown. It has resulted in giving

X-E 6285-9
(1884-01-29) 4

THE EDISON LAMP CO.,

East Newark, N. J., ... 188

a thorough organization to the details of the business.

Regarding the manufacturing

X-E62-78
1884-06-27

Form 26.

THE EDISON COMPANY, FOR ISOLATED LIGHTING.

SECRETARY'S OFFICE,
65 FIFTH AVENUE.

Dictated Letter.

New York, June 27th. *188*4.

Francis R. Upton, Esq.

Edison Lamp Co.

East Newark. N. J.

Dear Sir:-

It is with great pleasure that I advise you that at a meeting of the Board of Directors of this Company held at the offices of Messrs. Drexel, Morgan & Co. of Wednesday the 25th. inst. you were unanimously elected a Director of this Company to serve until the next Annual Meeting.

Yours very truly.

J. Hutchinson

Secretary.

per H.M.B.

X-E6285-9

CABLE ADDRESS—EDISON, NEW YORK.

Per S. S.

THOMAS A. EDISON,
No. 65 FIFTH AVENUE.

NEW YORK, 30th Oct 1884

Francis R. Upton Esq
Edison Lamp Co
Harrison N. J.

Dear Sir,

I regret very much to state that I shall be unable to meet the note for $2750 due on Nov 2nd. I have been unable to make collections I had anticipated getting hence my failure to keep my promise to you

Yours truly

Thos. A. Edison

J.

EDISON LAMP COMPANY.

THOMAS A. EDISON, President,
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

X-E6285-9
1884-10-31

EAST NEWARK, N. J., Oct. 31, 1884

Dear Mr. Edison:

About three months since by special arrangement with Mr. Insull, The Edison Lamp Co. left $4232.77 ~~cents~~ in your hands that you had collected as their agent, on the express agreement that you would meet a note for $2750.00 that would come to your office for payment on Nov. 3. Mr. Insull shook hands on the agreement. It was also understood that we would never call on you for the balance of the account

EDISON LAMP COMPANY.

THOMAS A. EDISON, President,
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

X-E6285-9 2.
1884-10-31

EAST NEWARK, N. J., 188

or for money due on

Mfg. Acct.	351.23
Con's "	787.90
	1,039.13

Making a total of $5,371.90 left in your hands to meet a note of one half the amount.

Today we received a formal note saying that you would not fulfill your obligation to us.

This compels us to pass a large portion of our payroll or all of it and to destroy the credit we are trying to build up at the bank by keeping a

X-E6281-9 3.
1884-10-31

EDISON LAMP COMPANY.

THOMAS A. EDISON, President.
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

EAST NEWARK, N. J.................188

small deposit.

There is ~~also~~ in addition to the sums mentioned due us from the machine works

370.50
566.60
$937.10

or a total of $6309—

We have always been ready to help you and intended to aid you when we left the balance mentioned in your hands, yet we feel that you should not throw us ~~overboard~~ without a word of help now.

Yrs. Truly
Edison Lamp Co,
By Francis R. Upton Mgr

[ATTACHMENT]

X-E6285-9

$2750 00/100 East Newark N.J. Nov 1st 1883

Twelve Months after date we promise to pay to

the order of Francis R. Upton

Twenty Seven hundred and Fifty — 00/100 Dollars

for value received at Office of Thomas A. Edison

#65 Fifth Ave. New York City

Edison Lamp Company.

No. 56 Due Nov. 4rd 1884 By

MATTHIAS PLUM, LITH. NEWARK, N.J.

[ATTACHMENT]

13323

Francis R. Upton
S. Bergmann.
Henry Weiler
Special act

FRANCIS R. UPTON COLLECTION

1885

X-E6298
1885-02-02

DEPARTMENT OF PHYSICS.
CORNELL UNIVERSITY.
WM. A. ANTHONY, PROFESSOR.
GEO. S. MOLER, ASS'T PROFESSOR.

Ithaca, N. Y., 2/2 1885

Mr. Upton.

Dear Sir.

I write to ask you if you could not give us a few lectures before the Seniors in Electrical Engineering on some subjects connected with electric lighting.

The University would of course pay all expenses, and probably something more. We have a good class of bright boys, who would be greatly benefitted by a few lectures from men who have seen so much as yourself of the practice as well as the theory of electricity

Another matter I will speak of. You have arranged for a competitive test of your machines under the auspices of the Franklin Institute. I was invited to act as one of the judges. I have been obliged to decline, partly because of my duties here, partly because I know I can do better work right

here at home than can possibly be done in Phila with the temporary arrangements that can only be available there.

We have here an observatory built expressly for such work, at a distance from all other buildings. All iron has been excluded from its construction. No iron nails were allowed near it even for stay-lathing or staging. I am setting up there a magnificent tangent galvanometer and electro-dynamometer combined. There are four stationary coils two of 200 cm. and two of 160 cm diam. The needle is dead beat and reads upon a circle 50 inches diameter.

A suspended coil serves both as a means of determining H, and as an electro-dynamometer. A potential instrument of the same general construction has Ger. Sil. coils of 100,000 ohms resistance. These are standard instruments but are made to give quick readings and can be used directly. I have also instruments for the "Vienna" methods of measuring. and have arranged also for measuring resistances, while current is flowing. within 1/1000 of their value. Our laboratory contains

X-E6298
1885-02-02

DEPARTMENT OF PHYSICS.
CORNELL UNIVERSITY.
WM. A. ANTHONY, PROFESSOR.
GEO. S. MOLER, ASS'T PROFESSOR.

Ithaca, N. Y., 188

the other necessary instruments, and we shall in a short time have determined all constants and be fully acquainted with all the idiosyncrasies of the instruments.

I would like nothing better than to take the identical machines that you send to Phila and test them here. Brackett and Young and other members of the old Phila committee would come up and help. With all apparatus permanently mounted, and thoroughly tested, sources of error discovered and guarded against, in a place free from all magnetic disturbances, of a local nature, I believe that tests can be made with an accuracy that has never before been approached and never can be approached under conditions such as must exist at exhibitions or in crowded cities.

Yours very truly

Wm A. Anthony.

DEPARTMENT OF PHYSICS,
CORNELL UNIVERSITY.
WM. A. ANTHONY, PROFESSOR,
GEO. S. MOLER, ASS'T PROFESSOR.

X-E62-9C
(1885)-04-12

Ithaca, N. Y., April 12th, 188

Francis R. Upton,-

My dear sir,-

The lecture room is 40 by 50 feet, the lecture table being on the side. The audience for the first three lectures will include few except the class for which the lectures were designed, about twenty in number. But at the last lecture on Friday there will probably be 75 or 100 present. I think we could make lantern slides from your blue prints, we certainly could from the tracings from which the blue prints were made. In that case we could throw them up to about twelve feet squareby my lantern which is always ready for use in my lecture room. The room will need to be only partially darkened. If you can send me the tracings I will have the slides made. I am a little afraid the blue prints will take white all over, but will try them if you cannot send the tracings.

Yours very truly

Wm A Anthony.

X-E62856
1885-05-29

The Office of Pontifex Refrigerating and Ice Making Machine Mfg. Co.
~~Mills Building, 35 Wall Street.~~
NEW YORK.

May 29-1885

E A Pontifex Esq.
London,

My dear Sir,

I take pleasure in introducing my friend, Mr F R Upton, of the Edison Co. a gentleman who is intimately connected with our great Inventor T A Edison. Mr Upton visits Europe on business & has large interests in Telemetry. he would I know, appreciate

seeing one of the great
Breweries in your City,
using the Pontifex
system of refrigeration,
and any attentions
shown to Mr Upton,
will I can assure
you be highly appreciated
by.
Yours very truly
C. Dewitt
Presdt. Pontifex Co.

X-E6285-6

E. A. Pontifex Esq
Mess Pontifex & Wood
Shoe Lane
London Eng

Introducing
Mr F. R. Upton
of New York.

X-E62-85-6
1885-05-29

The Office of
Pontifex Refrigerating
and
Ice Making Machine Mfg. Co.
~~Mills Building, 35 Wall Street.~~
NEW YORK.

May 29/85

W T Ready Esq
London

Dear Sir:
I take great pleasure in introducing to you my friend Mr F.R. Upton: a gentleman who is closely associated with me in some business relations, and thinking he may have a few hours of leisure I will highly appreciate any attention shown him in visiting the British Museum. I remain,
Yours very truly
R Hewitt

---

by Hewitt 1886 X-E62-85-6

W. Talbot Ready Esq
55 Rathbone Place
London
W.

Introducing Mr F.R. Upton of New York

X-E6285-6
1885-05-

New York City U.S.A.
May - '85.

My Dear Doc,

Allow me to introduce to you Mr Francis R. Upton one of Mr Edison's associates who is paying a short visit to Berlin, I always looked upon yourself & your good wife as the real representatives in Berlin of our american people, and I look back with great pleasure to the many pleasant times spent in your society kindly remember me to Mrs Sylvester and Florrie & with sincere regards for yourself I remain Very truly yours

Wm J Hammer

May 1885 X-E6285-6

Herrn Dr Sylvester

14 Voss Strasse

Berlin.

Introducing Mr Francis R. Upton.

X-E6285-6
1885-06-01

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, June 1st 1885

Sir Wm Thomson
My Dr Sir Wm

I want you to know my friend and associate Mr Francis R Upton who is identified with us in all branches of our Edison Industries in this Country and whose theoretical and practical knowledge of what we deal with is sufficient to guarantee for you an hour or so of interesting Chat - You will both gain by the exchange and I therefore do not hesitate to ask for my friend the same Courtesies that I know you would extend to me -

Trusting that you My Dr

Sir Wm Continue to enjoy an Elastic Constitution and your deserved happiness

I beg to remain

Most Affectionately Yours

Edw. H. Johnson

Form 45.
If not delivered in five days, return to THE EDISON COMPANY FOR ISOLATED LIGHTING,
65 Fifth Avenue, New York.

X-E6285-6

by Johnson 1885

Later Lord Kelvin 1885-06-01

Sir Wm Thomson
Glasgow University
Inquire of Sir Fredk Bramwell

X-E62-85-6
1885-06-01

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, June 1st 1885

Sir John Lubbock
My Dr Sir John.

This will introduce my friend & associate Mr Francis R. Upton Whom I send to you primarily because I wish you to Know him & learn from an intelligent theoretical & practical man What the real status of the Edison Industry in this Country is - there yet lingers with me a desire to stand exonerated in your mind from having indulged in a degree of enthusiasm not warranted by the thing itself - I long since admitted that it was not warranted

by the existing conditions in England. but that was chargeable to my ignorance and not to any spirit of misrepresentation

Thanking you in advance for the kind reception I know my friend will receive at your hands and trusting that you & all your good people continue to enjoy the blessings of Life Health & Happiness

I remain

My Dr Sir John

Very Sincerely Yours

Edw. H. Johnson

Form 45.
If not delivered in five days, return to The Edison Company for Isolated Lighting, 65 Fifth Avenue, New York.

X-E6285-6

Sir John Lubbock Bart.
c/o Robarts Lubbock & Co
Lombard St.
London

X-E6285-6
1885-06-01

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, June 1st 1885

My Dear Sir Frederick

This will introduce my friend and business associate Mr Francis R. Upton - He is identified with our Edison Industries in this Country in a large way, is a member of our Board - and is well up in the Theoretical branches of the business, I send him to you particularly as I want him to justify to You my contention that Friend Preece' observations on the English V.S. the American Lamps are based upon a superficial examination of the subject - By the bye - Preece "went for me lively

X-E6285-6
1885-06-01

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, ...188

2

for making that criticism of him - it must have been true? — Thanking you in advance for the Courtesies I know you will extend to my friend and trusting that You & Yours are still in the enjoyment of the blessings of this Life

I am my Dr fr Frederick
Most Sincerely Yours
Edw. H. Johnson

X-E6285-6
1885-06-01

Queen's Bench Court No. 3.

at 1.30 on Monday to meet Sir Frederick Bramwell.

Form 45.
If not delivered in five days, return to The Edison Company for Isolated Lighting, 65 Fifth Avenue, New York.

by Simson June 1st 1885 X-E6285-6

Sir Fred^k Bramwell
c/o Inst. Civil Eng^rs
25 Great George St
London

X-E6285-6
1885-06-01

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, June 1st 1885

My Dr Capt Shaw.

This will introduce my friend And Associate Mr Francis R. Upton who can tell you all About Edison & the rest of us and the progress we are making with the Edison Matters on this side of the Atlantic I send him to you As I want him to realize in his own person some of the Courtesies Englishmen - you particularly - so freely extended to me & of which he has so often heard me boast - Shew him your Dept & tell him a little of the Days When you took a young

American in hand and made him drunk with the flattering attentions of Older & more distinguished men - And come back with him & let us see you on this side of the Mill Pond once more

Thanking you in advance for the Courtesies my friend will receive at your hands & trusting that you & your good family are still "hale & hearty"

I remain as Ever

Very Faithfully Yours

Edwd H Johnson

Form 45.
If not delivered in five days, return to The Edison Company for Isolated Lighting, 65 Fifth Avenue, New York.

By Johnson 1885

X-E6285-6
1885-06-01

Capt Shaw
London Fire Brigade
Southwark

X-E6285.6

June 13th 1885

Dear Professor Adams

I have great pleasure in introducing Mr Upton to you, he is a partner of Mr Edison and is spending a short time in Europe.

Knowing that many of your interests are in the same subjects, I feel sure the acquaintance will give pleasure to both.

With very kind regards to Mrs Adams and your daughter

I am your sincere friend

Annie Fowler

X-E6285.6

Professor W. Grill Adams
Notting Hill Square
London West

[PHOTOCOPY]

Xerox copy X-E 62-85-6

Form L. 500-2-2-'85.

THOMAS A. EDISON,
NO. 65 FIFTH AVENUE,

New York, June 10 1885

My Dear Doctor Siemens

This will introduce to you my friend and associate Mr Francis R Upton who is visiting Europe in connection with the business of the Edison Lamp Co of which he is the General Manager

Mr Upton has been very closely connected with me in my laboratory work since my earliest experiments in Electric Lighting

Any courtesies extended to Mr Upton by your goodself will be highly appreciated by

Yours Very Truly

Thomas A Edison

To Dr Werner Siemens
Berlin

X-E6285-6
(1885-06)

THE EDISON ELECTRIC LIGHT CO.,
65 FIFTH AVENUE.

New York, ...188

Dr Werner Siemens

Berlin

Dear Sir

I take the liberty of introducing to you my friend and associate Mr Upton whom you probably well know by reputation as having contributed to the success of the Edison Lamp, any courtesies extended to him to enable him to see what is being done in Electric Lighting will be greatly appreciated by Mr Edison as well as by your humble servant

Chas Batchelor

By Charles Batchelor Undated

X-E6285-6

Dr. Werner Siemens
Markgarten Strasse
Berlin

X-E6285-10
1885-12-07

The Edison Ore Milling Company Limited

65 Fifth Avenue

New York 7th Dec 1885

Francis R. Upton Esq

Harrison N.J.

Dear Sir,

I beg to advise you that at a Special meeting of the Board of Directors held today you were elected a Director of the above Company

Please advise me of your acceptance of same & oblige

Yours truly

Sam Insull

Secretary

X-E6285-9
(1885)

Your esteemed favor of the 28th. inst. is before us and contents noted. The report of the Committee on Lamp Tests at the Franklin Institute Exhibition, Philadelphia, is not yet complete, and the statements which have appeared in the press notices with regard to the Committee's work have been misleading in the extreme as will appear from the report when ready. These tests can prove of but little practical value to the public, as the lamps tested were all special lamps, and not commercial lamps. The lamps exhibited by us were a new style of lamp, and were exhibited to show the developments in the state of the art. The testing Committee were formally notified that the lamps were comparatively worthless and that it would be time lost to make tests of them. We desired that regular commercial lamps be used for the tests but the Edison Company objected, and subsequently one of the Edison Company made the statement that they had made 1500 special lamps at great expense for these tests, 400 of which had been selected and sent to Philadelphia; that they knew the Weston lamps were defective, but proposed to insist on the tests and to use the result for all it was worth as an advertisement, We mention this for your information with regard to the tests. As a matter of fact, our commercial lamps wherever used under normal conditions show a much longer life than any other lamps known and require much less energy to operate them. We send you by this mail a circular published some little time since, and invite your attention to the testimonial of Grant Bros. on page 31, in which they show the average life of lamp at 2207 hours; Pillsburg Flour Mills, page 32, show a very long life of lamps; H. & D. Henry, see page 35, show average life of

X- E6285-9

their lamps has been 4800 hours. If you were here we could show you lamps which have been in use more than 6000 hours, and we are frequently asked to furnish our lamps for use on Edison machines as parties have found the breakage of Edison lamps has been excessive. If your lamps are not lasting well, it is caused from some disturbance upon your circuit, or a desire to obtain a light in excess of what the lamp is constructed for. These lamps are made to give 16 candle lights, and at that degree of illumination will have a long life. If, however, they are forced up to a higher degree of brilliancy the direct tendency is to shorten the life of lamps and that rapidly. Will you kindly inform us just what your experience is in this regard, together with the number of revolutions at which you are running your dynamo, and state whether any change has been made in the circuit since it was first erected, when we shall take pleasure in investigating the matter fully and advise you with regard to any modifications in the operation of your plant which should seem desirable.

Yours truly,

(Signed) O. W. Hobard,

President.

Form 1 A. X-E6285-8

All Communications to be addressed to the Office.

Works, 104 Goerck Street.

EDISON MACHINE WORKS.

OFFICE, 65 FIFTH AVENUE.

New York, ...188

Upton

Mr Bell man House

from Orange has [illegible]

wants $1000. Stock --

what can you do --

E

FRANCIS R. UPTON COLLECTION

1886

E-6285-8
1886-01-02
- see - over - also

SUBJECT: Defect report.

JOHN M. CLARK, President.
ANTHONY F. SEEBERGER, Vice-Pres't.
F. S. GORTON, Treasurer.
D. H. LOUDERBACK, Secretary.
GEO. H. BLISS, Gen'l Supt.
P. D. JOHNSTON, Engineer.

WESTERN EDISON LIGHT COMPANY,

186 DEARBORN STREET,

DIRECTORS:
THOMAS A. EDISON,
ROBERT T. LINCOLN,
JOHN B. DRAKE,
J. W. DOANE,
SAMUEL MERRILL,
NORMAN WILLIAMS,
EDSON KEITH,
JOHN M. CLARK,
JOHN CRERAR,
ANTHONY F. SEEBERGER,
Z. G. SIMMONS.

Dictated.

CHICAGO, Jan. 2, 1886.

The Edison Lamp Company,

Newark, N.J.

Gentlemen:

As I mentioned the other day in a letter to you, the breakage which we have been experiencing with lamps out here during the past two months has been something very excessive. We received the following letter to-day from the Manitou Iron Springs Hotel;

"Western Edison Light Co., Chicago. The last lot of lamps which we received from you are very short lived, some only burning from 50 to 60 hours, and as they are used in the same circuit with lamps that have been burning many months it is very evident that there must be some defect in the new ones as the old ones still survive. Can you give any explanation? I have endeavored to keep the current as uniform as possible, and am always careful to avoid overcrowding."

Very truly yours,

Western Edison Light Co.

Gen'l Supt.

Edison
How is this? or do you believe it?
EHJ
Over

X-E6285-8
(1886-01-02)
see - over -
also

Upton - How would it do for you to
personally learn the Lamp Business
~~Ie~~ (ie) The Carbonization - You are a
Scientific man like myself Batch
Etc. It seems to me if I was
running the Lamp factory that
there wouldn't occur any such
thing as losing the art,
As the financing is rather Easy
I suggest you do like the rest
of us learn the business
thoroughly & not be dependent
on others - you are degenerating
into a mere business man - Money isn't
the only thing in this mud ball of ours
T A E

EDISON LAMP COMPANY.

THOMAS A. EDISON, President,
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

X-E62859
1886-01-16

EAST NEWARK, N. J., Jan. 16, 1886

To the Directors of the Edison Lamp Co.

The year 1885 has been a prosperous one.

The business has increased and the expenses have been reduced.

We can look forward to another good year, if we can hold the price of the lamps where it is, and not be compelled to change our styles.

During the coming year we shall be called on for some heavy expenses. We must fit up two extra mercury pumps and buy new boilers;

EDISON LAMP COMPANY.

THOMAS A. EDISON, President,
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

X-E62859
1886-01-16

EAST NEWARK, N. J., 188

this with the needful expenditure for an enlarged business will probably prevent us from declaring more than two per cent quarterly in dividends.

On the U. S. it is probable that a reduction of prices must be made, by giving a royalty to the Edison Light Co.

Abroad competition must be met. Siemens and Halske of Berlin will probably be our strongest competitors.

We can however look to such an increase in our sales as to offset any losses we may meet in reduction of prices.

Francis R. Upton Treas.

1885 report

not ready

X-E62-98
1886-06-01

THE EDISON LAMP CO.,

East Newark, N. J., June 1, 1886

Cash on hand May 24th	$2939.95	
Ill Co. Brockton, Mass.	75.50	
P.S. Dyer Agt. Draft #6	2891.57	
Drafts for Coll.	852.05	
Ill Co. Lawrence Mass	77.00	
" " Harrisburgh Pa.	471.75	
" " Hazleton Pa.	54.40	
" " Wms Port Pa	211.70	
P.S. Dyer Agt. Draft #7	963.86	8537.76
Disbursements		
Dyer & Seely	1080.00	
Pay Roll	1800.00	
Pratt & Whitney	499.60	
C. F. Stilwell	341.67	
Cons Fruit Jar Co.	564.02	
Corning Glass Works	3000.00	
Bergmann Co. Refund a/c	366.62	
Sundry Bills for Previous month	1721.29	$9373.20

Paper in Bank. no account received yet of them.
The Isolated Co. Notes $7609.04
Draft P.S. Dyer #8 15000 francs 2800.00
Foreign orders 1300. Isolated Co. 3102 Central Station 3234

x-E6298

Kurfurstendam, 3, Berlin, June 21. 86

Dear Sir,

Since you left, I have had two conferences with Werner Siemens with the result that he agreed to send me to-day or to-morrow a written basis for a compromise with the German Company. I have deemed it best not to approach the latter until I had this in hand. But I shall

ask Mr Rathenow for an appointment immediately upon receiving Mr Siemens proposal.

I shall write or telegraph before you leave Paris whatever result may be reached.

Please let me know whether you have done anything with the compressed flour man. I should be glad to interest myself with you in the invention, if it proved a practical thing.

Will you remember about the engagement of two rooms at your hotel for 29. inst. & oblige

Yrs truly

H. Villard

Please communicate foregoing to Mr Rau & tell him, I will write him after reaching some conclusion with the German Co.

E-6124-37

37

EDISON LAMP COMPANY.

THOMAS A. EDISON, President.
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

EAST NEWARK, N. J., July 9, 1886

Dear Mother:

My voyage was very pleasant as to weather and company. We reached N.Y. Sunday morning early. I had bowel complaint during the last three days keeping me in my room for two days. Edison has been at the factory while I was away and did some ~~up~~ setting of processes and much talking. Business is now getting into good shape and the prospects for fall trade are very encouraging. All are well at home. Edgar writes that Henry expects to go at business very soon. My home in Orange is looking beautifully. I have plenty of work and some good things on

hand. I expect to go to Duxbury to spend Sunday and return with Edgar on Monday night.

I saw your old friend the Blaine Custom House officer, and he passed Mrs. Graves's trunks through without opening them.

Much love to you and Mrs Gregg.

Yr Loving Son

Francis R. Upton

X-E6298 St Moritz, Engadin,
Switzerland, July 25. 86.

F. R. Upton, Esq.

Dear Sir,

Your favor of 9. inst. has reached me at this point via Berlin.

I am glad to learn that you arrived safely on the other side & that Mr Edison is satisfied with my plans. I assume you have been informed of the contents of my letter to the Edison Co. regarding the satisfactory results of my efforts. I hope now that Mr Siegel has

[1]

notified Mr Edison of his free assent to the transfer of his power to me, the promised power of attorney will be forthcoming. But up to this writing nothing has come to hand. I can hardly proceed further without it.

It would not be worth while for me to become interested in the bonds unless a larger amount of them can be secured. Under the understanding arrived at, the benefit of the purchase would go to the proposed new company & the

[2]

latter, of course, would not care to go into so small a transaction. I am obliged to you at the same time for your kind offer & will be glad to hear from you by letter or cable if a considerable amount of the bonds can be ~~had~~ bought. The new company project will not be actually taken in hand until my return to Berlin towards the end of ~~next month~~. All purchases of

[3]

bonds would be turned over to it by me at cost.

I have not heard anything regarding the compressed flour patent from Mr Dyer.

Sincerely yrs
H. Villard

[4]

X-E6298

Berlin, 19.9.86.

F. R. Upton, Esq.

Dear Sir,

I have your two last favors.

I have not heard anything from Mr Dyer since you left. As I expect to be in New-York within five weeks from to-day, I will be able to receive your further ~~[illegible]~~ news about the aluminium process in person.

I have written at length to the Edison boys to-day regarding the

difficulty which, what I am
inclined to think is an
intrigue of Mr Lane, has
placed in my way.

Truly yrs
H. Villard

X-E62-85-6
1886-11-05

FOR THE PROTECTION AND PROMOTION OF TRADE.

THE MERCANTILE AGENCY,

Established, 1841.

R. G. DUN & CO.,

314 AND 316 BROADWAY, NEW YORK: BRANCH CITY OFFICE, 83 WALL STREET, AND PRINTING OFFICE, 57, 59 AND 61 PARK STREET.

BRANCH OFFICES IN ONE HUNDRED AND ELEVEN CITIES, AS FOLLOWS:

R. G. DUN & CO.	Charleston, S. C.	Dubuque, Iowa.	Houston, Texas.	Milwaukee, Wis.	Philadelphia, Pa.	Salt Lake City, Utah.	Waco, Texas.	Toronto, Ont.
	Chattanooga, Tenn.	Duluth, Minn.	Indianapolis, Ind.	Minneapolis, Minn.	Pittsburgh, Pa.	San Antonio, Texas.	Wheeling, W. Va.	Hamilton, Ont.
Albany, N. Y.	Chicago, Ill.	East Saginaw, Mich.	Jersey City, N. J.	Mobile, Ala.	Portland, Oregon.	San Francisco, Cal.	Wichita, Kan.	London, Ont.
Allentown, Pa.	Cincinnati, O.	Elmira, N. Y.	Kansas City, Mo.	Montgomery, Ala.	Providence, R. I.	Savannah, Ga.	Williamsport, Pa.	Halifax, N. S.
Atchison, Kan.	Cleveland, O.	Erie, Pa.	Keokuk, Iowa.	Nashville, Tenn.	Quincy, Ill.	Scranton, Pa.	Winona, Minn.	St. John, N. B.
Atlanta, Ga.	Columbus, O.	Evansville, Ind.	Knoxville, Tenn.	Newark, N. J.	Reading, Pa.	Sioux City, Iowa.	London, England.	Winnipeg, Manitoba.
Austin, Texas.	Council Bluffs, Iowa.	Fargo, Dak.	La Crosse, Wis.	New Haven, Conn.	Richmond, Ind.	Springfield, Mass.	Manchester, England.	E. RUSSELL & CO.
Baltimore, Md.	Dallas, Texas.	Fort Worth, Texas.	La Fayette, Ind.	New Orleans, La.	Richmond, Va.	Springfield, Mo.	Glasgow, Scotland.	Boston, Mass.
Binghamton, N. Y.	Davenport, Iowa.	Galveston, Texas.	Leavenworth, Kan.	Norfolk, Va.	Rochester, N. Y.	Springfield, O.	Paris, France.	Fall River, Mass.
Birmingham, Ala.	Dayton, O.	Gloversville, N. Y.	Lincoln, Neb.	Omaha, Neb.	Rockford, Ill.	Syracuse, N. Y.	Berlin, N.W., Ger.	Lynn, Mass.
Buffalo, N. Y.	Denver, Col.	Grand Rapids, Mich.	Little Rock, Ark.	Oswego, N. Y.	St. Joseph, Mo.	Toledo, O.	DUN, WIMAN & CO.	Portland, Me.
Burlington, Iowa.	Des Moines, Iowa.	Hartford, Conn.	Louisville, Ky.	Ottumwa, Iowa.	St. Louis, Mo.	Troy, N. Y.	Montreal, Que.	Worcester, Mass.
Cedar Rapids, Iowa.	Detroit, Mich.	Helena, Mont.	Memphis, Tenn.	Peoria, Ill.	St. Paul, Minn.	Utica, N. Y.		

P. O. BOX 803.

NEW YORK, NOVR 5TH 1886. 188

MY DEAR ALLOO;

THE BEARER IS A GOOD FRIEND OF MINE, MR F. UPTON, OF NEWARK AND NEW YORK, CONNECTED WITH THE EDISON COMPANY AND ALSO ASSOCIATED WITH ME IN THE TELEMETER, WHICH HE WILL EXPLAIN TO YOU. WE SHALL PERHAPS WANT TO FLOAT IT IN FRANCE ONE OF THESE DAYS. IT IS A FIRST CLASS INSTRUMENT AND LIKELY TO BE VERY SUCCESSFUL.

I COMMEND MR UPTON TO YOUR CONFIDENCE AND GOOD WILL.

FAITHFULLY YOURS

Erastus Wiman

Introductory

X-E62-85-6

Louis J. Alloo Esq

R. G. Dun & Co.

Rue Chauchat 5

Paris

8

The Undersigned:

Mr. Upton, in the name of the Edison Lamp Factory. Harrison (New Jersey) of whom he is the attorney & for whom he binds himself

Of the first part:

And Mr. Rau, Louis, acting in the name of:

1º The Compagnie Continentale Edison.

2º The Societe Electrique Edison.

3º The Societe Industrielle & Commerciale Edison

hereafter called the French companies,

Of the second part:

Agree as follows:

The French Companies bind themselves to offer to all their customers (those of France being excepted as long as the lamp patents of Mr. Edison remain in force in that country) Edison lamps manufactured indiscriminately by the Edison Company or by the European Edison Companies, and to sell and invoice such lamps at a uniform price based upon the candlepower, their number of volts and amperes without distinction as to whether they come from the American Company or are manufactured in Europe.

The French Companies will offer as much as possible lamps of the same type as those of the

X-E6298
1886-11-25

Les Soussignés:

Mr. Upton, au nom de la Edison Lamp Factory à Harrison (New Jersey) dont il est le mandataire et dont il se porte fort,

D'une part;

Et Mr. Louis Rau, agissant au nom de:

1º La Compagnie Continentale Edison

2º La Société Electrique Edison,

3º La Société Industrielle & Commerciale Edison,

appelées Sociétés Françaises dans ce qui suit:

D'autre part;

Conviennent de ce qui suit:

Les Sociétés Françaises Edison s'engagent à offrir à tous leurs clients (ceux de France exceptés tant que les brevets pour lampes Edison seront en vigueur dans ce pays) des lampes Edison indistinctement fabriquées par la Edison Lamp Company ou par les Sociétés Edison Européennes et à les vendre et facturer à un prix uniforme basé sur leur pouvoir éclairant, leur nombre de volts et d'ampères, qu'elles proviennent de la Cie Américaine ou de fabrication européennes.

Les Sociétés Françaises offriront, autant que possible les mêmes types de lampes

American Company and bind themselves not only to leave their customers absolutely free to choose such lamps, but also to mention in all their publications and catalogues excepting those for France, the priviledge which is offered to such customers.

The Edison Lamp Company, as well as the French Companies, shall not publish anything which might affect the good name of lamps coming from the one or the other of them.

They bind themselves also to communicate on request, to each other mutually, the substance origin and prices of all raw materials, used for manufacturing incandescent lamps.

As in the past, the French Companies bind themselves to furnish lamps to the German and Italian Edison Companies at the same prices as those fixed for the French Edison Companies by the Edison Lamp Company, but the royalty which may eventually be due to the French Companies shall not be included in such prices.

The Edison Lamp Company and the French Companies shall communicate to each other mutually, complete lists of all customers, and

(2)

que la Société Américaine s'[illegible]gagent, non seulement à laisser leurs clients absolument libres quant au choix de ces lampes, mais encore à faire mention sur toutes leurs publications et catalogues, exceptés ceux pour la France, de la dite faculté qui leur est accordée.

La Edison Lamp Company, de même que les Sociétés Françaises, s'engagent à ne rien publier de nature à porter atteinte à la valeur des lampes de l'une ou l'autre de ces deux provenances.

Elles s'engagent en outre à se communiquer mutuellement sur demande les sources, provenances et prix de toutes matières premières employées dans la fabrication de la lampe à incandescence.

Comme par le passé, les Sociétés Françaises s'engagent à fournir aux Sociétés Allemande & Italienne Edison les lampes aux mêmes prix que ceux qui sont faits aux Sociétés Françaises Edison par la Edison Lamp Compᵍ mais sans que la redevance éventuelle due aux Sociétés Françaises soit comprise dans ce prix.

La Edison Lamp Company et les Sociétés Françaises se transmettront mutuellement la liste complète de leurs clients et se

will ma… known to each other the electro motive power of the lamps which such clients use. This list shall be exchanged monthly.

The Edison Lamp Company and the French Companies shall also communicate to each other mutually all the prices and the conditions upon which lamps can be supplied in the various countries, but the French Companies will not have the right to sell incandescent lamps on the American Continent nor in England and its colonies.

The Agent of the Edison Lamp Company at Antwerp shall have the right to make direct offers to all customers, outside of France, of the French Companies at the same prices and conditions as those ordered by the French Companies, but under the special condition that all orders given by such customers shall pass through the channel of the French Companies which alone shall determine whether they accept or refuse such orders, unless the Edison Lamp Company pays in cash to the French Companies the total amount of such orders which the French companies refuse to execute. If a special licence is given by the French Companies for a country or a district, then the Lamp Company and its agent shall

feront connaître la force électro motrice des lampes dont ces clients se servent. Cette liste sera échangée mensuellement.

La Edison Lamp Company et les Sociétés Françaises se communiqueront également tous les prix et toutes les conditions auxquelles les lampes peuvent être livrées dans les différents pays, mais les Sociétés Françaises n'auront le droit de vendre des lampes à incandescence ni dans les deux Amériques, ni en Angleterre et ses colonies,

L'agent de la Edison Lamp Company à Anvers aura la faculté de faire des offres directes aux clients situés hors de France des Sociétés Françaises, et ce, aux prix et conditions indiqués par les Sociétés Françaises; mais sous la condition spéciale que les ordres donnés par ces clients passent par le canal des Sociétés Françaises qui seront seules juges des ordres qu'elles voudront accepter à moins que la Edison Lamp Company ne verse comptant aux Sociétés Françaises le montant des ordres que ces Sociétés n'auraient pas voulu accepter. Si une licence exclusive est donnée par les Sociétés Françaises pour un pays ou un district, la Lamp Company ou son agent ne pourront plus faire livraison dans

not have the right to make any delivery of goods in that country excepting to the grantee of the licence.

The Edison Lamp Company binds itself to invoice the said Lamps and to sell them to the French Edison Companies at the prices & conditions made to the most favored customer or buyer wherever they may live and who ever such customers may be and to whatever quantities the prices may apply.

The highest price for goods sent free on board at Antwerp (packing charges included for lots of 500 lamps and above) shall be.

frs. 1.75	for lamps	of 8	candles
" 2. "	"	16	"
" 2.25	"	13 & 20	"
" 2.50	"	10 & 24	"

These prices can be maintained by the Edison Lamp Cy as long as the net prices obtained by the French Cies on the greater number of their orders shall be at least frs. 3.25 for lamps of 8, 16, 13 & 20 candles and frs 3.50 for lamps of 10 & 24 candles.

These prices only apply to sales made to customers other then the Edison Companies of Europe and shall not apply in contracts wherein the profits of the French Companies is different from what is obtained by the sale of lamps.

ce pays ou ce district qu'à ce porteur de licence.

La Edison Lamp Compy s'engage à facturer les lampes dont il s'agit et à les vendre aux Sociétés Françaises aux prix & conditions de ses clients ou acheteurs les plus favorisés, où qu'ils demeurent & quelque soient les clients ou acheteurs dont il s'agit & quelles que soient les quantités auxquelles les prix s'appliquent.

Le maximum de ces prix franco à bord Anvers (emballage compris pour des expéditions de 500 lampes et au-dessus) sera de :

1.f75	pour les lampes	de 8	bougies
2.f "	"	" 16	"
2.f25	"	" 13 & 20	bougies
2.f50	"	" 10 & 24	bougies

Ces prix pourront être maintenus par la Edison Lamp Company, tant que le prix net obtenu par les Sociétés Françaises pour la majorité de leurs ordres sera de 3.f25 au moins pour les types de 8, 16, 13 & 20 bougies et 3.f50 pour ceux de 10 & 24 bougies.

Ces prix ne s'appliquent qu'aux ventes faites à des clients autres qu'à des Compagnies Edison d'Europe et ne trouvent pas non plus leur application dans les traités où le bénéfice des Sociétés Françaises serait autre que celui obtenu par la vente des lampes.

Si les Sociétés Françaises étaient obligées de diminuer le prix de vente des lampes, la Edison

; the French Companies are obliged to reduce the prices of the lamps, then the Edison Lamp C° shall also be obliged to reduce its price of sale one half of the reduction made by the French C^ies and the said French C^ies shall not be able to ask that such price be put below the price of manufacturing French Edison Lamps of the French Companies with an increase of 25%.

The goods of the Edison Lamp C° sold to or through the French C^ies shall be payable at Paris by the French Edison C^ies.

The Edison Lamp C° binds itself only to make sales through the French C^ies on the whole continent of Europe, excepting in Norway, Sweden, and Portugal, and to prohibit all its customers and purchasers to whom it will sell lamps, from selling Edison lamps in any of the following countries: France & French Colonies, Belgium, Denmark, German Empire, Austria Hungary, Russia Italy, Spain (except the Spanish Colonies)

The Edison Companies undertake to execute without profit all orders for delivery which the Lamp Company will give for the Société d'Appareillage Electrique at Geneva for use of lamps so delivered in Switzerland only.

Any violation direct or indirect

Lamp Company, de son côté, serait obligée de diminuer son prix de vente de la moitié de la diminution consentie par les Sociétés Françaises, sans que ces Sociétés puissent demander que ce prix descende plus bas que le coût de fabrication des lampes Edison Françaises, majorées de 25%.

Les marchandises vendues à ou vendues par la Edison Lamp Company seront payables à Paris par les Sociétés Françaises Edison.

La Edison Lamp Company prend de son côté l'engagement de ne vendre que par les Sociétés Françaises sur tout le continent Européen, excepté pour la Norwège, la Suède et le Portugal et d'interdire à tous clients et acheteurs à qui elle vendra des lampes, de pouvoir revendre ces lampes dans un des pays suivants:

France & Colonies Françaises
Belgique
Danemark
Empire d'Allemagne
Autriche-Hongrie
Russie
Italie
Espagne (les Colonies Espagnoles exceptées)

Les Sociétés Edison s'engagent à exécuter sans bénéfice tous les ordres de livraison que la Lamp Company lui donnera pour la Société d'appareillage

by a purchaser of the Lamp Company of the prohibition to use or sell again the said lamps in another country will carry with it the obligation, after notice shall be given by the French Companies to the Edison Lamp Company, to refuse all delivery of Edison Lamps to such a person without prejudice of any claim to be brought against such person by the French Edison Companies.

If the Edison Lamp Company should not execute the orders it may receive from the French Edison Companies in a delay of thirty days from the receipt of such orders by the agent of the Lamp Company, the said companies shall have the right to cancel such orders and deliver lamps manufactured in Europe instead and in lieu of the American lamps so ordered.

This delay of thirty days for delivery will only apply to orders coming from customers and not to orders given by the French Edison Companies to replenish their stock.

This agreement is made and accepted for the same length of time as the one resulting from

Electrique de Genève pour employer les lampes ainsi livrées en Suisse seulement.

Toute infraction directe ou indirecte par un acheteur de la Lamp Company à l'interdiction de se servir ou de revendre les lampes dont il s'agit pour un autre pays, entraînera, après qu'avis aura été donné par les Sociétés Françaises à la Edison Lamp Company, l'obligation par elle de refuser toute livraison de lampes Edison à tout contrevenant, sans préjudice de tels recours à exercer contre ce contrevenant par les Sociétés Françaises Edison.

A défaut par la Edison Lamp Company d'avoir livré les commandes qui lui seront données par les Sociétés Françaises Edison dans les trente jours après réception de ces commandes par l'agent de la Lamp Company, celles-ci pourront annuler leur ordre et livrer des lampes de fabrication Européenne aux lieu et place des lampes Américaines objet de ces commandes.

Ce délai de trente jours pour livraison ne s'appliquera qu'aux commandes provenant des clients, et non à des commandes faites par les Sociétés Françaises Edison pour emmagasiner.

Les présentes conventions sont consenties et acceptées pour la même durée que celle résultant du dernier

the last section of the first paragraph of article six of the contract made the 25th November 1886 between the French Companies and Mr. Edison and the Edison Electric Light Company, but in case of liquidation before then, of the Edison Lamp Company or of the Company which may take the place of the existing French Companies under the same contract, this agreement shall become thereby null and void without damages from either side.

In case of violation of this agreement by one of the contracting parties and in case a decision should be rendered either by arbitration or by the Courts fixing the amount of the damages due by one party to the other, the party against whom the decision is rendered shall independently of the damages resulting from the arbitration or judgement, pay to the other party five times the same amount as penalty.

This agreement annuls the contract made the 6th of August 1885 between the French companies and the Lamp Company.

Done in duplicate at Paris, the twenty fifth day of November 1886.

alinéa ou premier paragraphe de l'Article 6 du traité conclu en date du 25 novembre 1886, entre les Sociétés Françaises et Mr. Edison et la Light Company, mais en cas de liquidation anticipée de la Edison Lamp Factory ou de la Société qui prendra lieu et place des Sociétés Françaises existantes en vertu de ce même contrat, la présente convention deviendra nulle de plein droit sans indemnité de part ni d'autre.

En cas de violation du présent contrat par une quelconque des parties contractantes et si une décision arbitrale ou judiciaire intervenait et fixait le montant du dommage causé par une des parties à l'autre, la partie condamnée devra, indépendamment des conséquences entraînées par l'arbitrage ou le jugement, payer à l'autre partie cinq fois le même montant à titre de pénalité.

Le présent annule le traité intervenu le six Août 1885 entre les Sociétés Françaises et la Edison Lamp Company.

Fait double à Paris, le vingt cinq novembre mil huit cent quatre vingt six.

Friday 6½ P.M.

My dear Major Upton.

I have just written to Mr Coster, telling him that it was my most conscientious opinion that you had all through been actuated by the desire to do the best that could possibly be secured for the benefit of the NYPCo, that you had a very hard fight to accomplish what you did & that I believed you had acted throughout most honorably, that he was at liberty to quote me & my words to Mr

(1888) X-E6285-10

Edison or anyone else interested in NYPC, when I thought they all looked & judged now through different & brighter glasses than when you left NYPC and the whole affair was nearly worthless.—

Of course it will be best, you should not let on (to anyone) that I wrote to Mr Coster as stated, but I thought it but plain justice to you, I should tell you so.—

"Bon voyage" and a bright & prosperous year to you. Sincerely yours

John W. Harjes

HARJES

X-E62-85-9
(1886)

~~after settling di~~
Edison New York
after making workable
~~Contract~~ ~~arrangement~~ between European
interest Villard is promised
large capital towards building
central stations everywhere
This with your ~~your~~ full
powers ~~enables him~~
~~get strong contract~~ guaran-
~~teeing~~ willfbam minimum and ~~largely~~
increasing ~~lamp royalty~~
guaranteed ~~your~~ lamp royalty.
Rau coming here I stay.
Quick favorable action im-
perative

Oscar Sauerwald.

Upton

[ON BACK OF PRECEDING PAGE]

OSCAR SAUERWALD

FÄCHER-FABRIK

SPECIAL-GESCHÄFT FÜR FÄCHER JEDEN GENRES UND FEINE BIJOUTERIEN

BERLIN W.

Friedrich-Strasse 190, nahe der Leipziger Strasse.

Geschäftsprincip:

Billige feste Preise.

AUFTRÄGE
nach ausserhalb
werden
prompt effectuirt;
auf Wunsch auch
Auswahlsendungen.

Ew. Hochwohlgeboren

nehme ich mir hiermit die Freiheit, meine Firma in freundliche Erinnerung zu bringen respective auf dieselbe ganz ergebenst aufmerksam zu machen, und erlaube mir nachstehend ein kleines Verzeichniss der in grosser Auswahl auf Lager befindlichen Neuheiten zu überreichen.

Indem ich bitte, bei Einkäufen in meinen Artikeln mein Magazin mit gütigem Besuche beehren zu wollen, zeichne ich

mit vorzüglicher Hochachtung

Ew. Hochwohlgeboren ganz ergebenster

Oscar Sauerwald.

Recently [illegible] [illegible] ~~[illegible]~~
Dillard [illegible] Nan + Nathan
together

X-E 62-98
(188-)?
1

THE EDISON LAMP CO.,

Menlo Park, N. J., ______ 188

There is one feature of ~~can~~ electricity that is to me very interesting, that is the complete removal of all knowledge of its causes or effects from the ordinary life of ~~mit~~ mankind.

Tyndal sums up the early history of mans acquaintance with electricity in a few words. "Many centuries before Christ it had been observed that yellow amber (electron) when rubbed possessed the power of attracting light bodies. This is the germ out of which has grown the science of electricity, a name derived from the substance in which the power of attraction was first observed. This attraction was the sum of the worlds knowledge for more than 2000 years"

Nothing ~~can be~~ is more impressive of the complete removal of a knowledge of electricity from ~~our~~ our daily life than Tyndals illustration above cited.

that men should have observed nature for so many years and only reported one fact. Nor is it astonishing when we examine closely our knowledge of today.

Our study of electricity sometimes seems to me like the study of light by a blind man. He would be compelled to translate all the phenomena we see into secondary effects, the image we see he would have to make known to him possibly by varying the thickness of a photographic plate so that he could feel it. Having no sense perception of one of the great forces of nature he would be compelled to change the ~~other~~ force into ~~one that~~ some effects that his others senses could appreciate. He would be compelled to reason back to causes which we can see directly.

Thus ~~having~~ also regarding electricity we know scarcely anything regarding it from our senses directly what we know is from experiments in which we are compelled to reach conclusions by our reasoning powers.

We cannot see electricity, we only see the heated gases in the lightning, we cannot hear it, we only hear the the air

rushing together after the flash causing the thunder. Neither can we smell ~~of~~ or taste it. We can only feel it as ~~we~~ it passes through our bodies but little can we learn from this.

~~Wanamaker~~ At Phila. a year ago. Fires
Boilers
Engine Belts Mass. iron copper
Wires Galvanometers Heat

Pearl St. Station.
1000 Horse power
Warm rods of copper.

We reach much the same conclusion regarding electricity as a blind man would reach regarding light, We know many of its effects but not much as to what it is

Yet though we cannot see, taste, or hear or smell ~~or taste~~ electricity we can as you all know measure it. We soon find that we are dealing with an agent that is always true to its own nature

~~Though [illegible] That electricity impresses one that is dealing with it in large quantities on a commercial basis, adding something how does not seem for~~

~~In dealing with electricity~~ I commercial

& ~~we look on~~ it as ~~simply~~ energy

and that ~~one~~ man can depend on to his bidding.

From a commercial point of view I look on electricity as a fluid similar in many respects to gas and water.

It is a reality in this way as much as the gas that runs through ~~the~~ my meter of to light my house: with gas a clicking sound can be heard at the meter and a hand be seen to move; much faster than it should judging by the bills; in electric lighting a deposit of zinc is made much less than should be the case if one is the seller instead of the buyer of light.

In dynamical electricity the energy that is carried is the main point and I am inclined to ~~always~~ think that ~~it~~ is ~~commercially~~ practically well to consider electricity as simply C E or as energy. as This ~~seems~~ seems

to render it more tangible. This brings us at once back to the fundamental conceptions of our surroundings.

The pysical world is made up of the two elementary principles matter and energy. Each of these is so far as we know indestructible, and the same today as for all past time in amount in the visible universe. What the ultimate nature of either is we do not know. We know that that the two ultimate elements are closely related by exact laws with laws with each other. A pound of zinc is always a pound of zinc and when we burn it in any way we always have a ~~certain~~ definate amount energy given off. A ton of coal burned under a boiler will drive an electrical machine doing stated work for a given time.

In practical electric lighting there is very little to with othese phases of electricity than as representing the energy of the power that turns the ~~m~~ dynamo machines. $CE \times 44.\cancel{4}3 =$ foot-pounds per minute is the most useful formula.

in practice and one that should always be carried in the head. This with the elementary formula of Ohm's laws will

$E = CR \quad C = \frac{E}{R} \quad R = \frac{E}{C}$

serve as a basis for most of the calculations that are required at a moments notice.

It is horse power that we have in our stations as the unit and to horse power or foot-lbs we should reduce all statements to make them easily understood. In electric lighting and distribution of power it is ft-lbs or H.P. that costs and what are wanted by the consumers. Thus as said one becomes accustomed to think of electricity as ~~the~~ energy and inclined to leave to ~~&~~ the laboratory or the telegraphist ~~the~~ engineer the ~~finer~~ notions of coulombs in defining electricity.

Thus as we ~~have~~ ~~see~~ ~~energy~~ recognize electricity in large quantities in practice, it is energy in a very agile form that interests us. In ~~E~~ electricity we have a servant that travels with a speed aproximating that of light, and when so traveling representing the energy of

of the coal or zinc that we desire to utilize and ever ready to change its form at our bidding to useful forms of work.

The first in order is the means of making electricity. ~~or of rendering~~

In glancing at the history of electric science ~~and~~ four periods of activity may be noticed

The ~~early~~ first period has been alluded to as the one in which the phenomena depending on the rubbing of vitreous bodies was ~~so~~ to a limited degree

X-E6298 1
(1880)

Introduction. Historical division

In order that my subject may fall under the purposes of this division I have entitled it the "History of the Edison Light." ~~Furthermore~~ That I may the better show the relation of present work to the past I have thought it best to give the outline of the history of our knowledge of electricity.

The early history of electricity has been summed up by Tyndal in a few words, "Many centuries before Christ it had been observed that yellow amber (electron) when rubbed possesed the power of attracting light bodies - This is the germ out of which has grown the science of electricity, a name derived from the substance in which the power of attraction was first observed. This attraction was the sum of of the worlds knowledge for more than 2000 years."

This phenomenon is so trifling as ~~not~~ to make but little impression on the mind of the observer. *
Experiment

Nothing is more impressive ~~to me~~ of the complete removal of a knowledge of electricity from our daily life than the ~~fact~~ illustration just cited, that men should have observed nature for so many years and only reported one fact.
~~Person~~ The study of electricity sometimes seems to me to resembling the study of light by a blind man. We ~~must~~ know so little by means of our senses directly, the expiriments are generally such that the results must come from our reason almost entirely. We cannot see electricity; we only see heated gases in the lightning; we cannot hear it, we only hear the air rushing together, after the flash, causing the thunder.

Neither can we smell or taste it. We can feel the charge as it passes through our bodies but from this we ~~can~~ learn but little.

~~When~~ We ~~are~~ reach very much the same conclusion ~~that a blind~~ regarding electricity that a blind man would reach regarding light, we know of many things that it will do, but not very much as to what it is.

In the ~~study~~ laboratory ~~are~~ the chief instrument by which our knowledge is gained is the ~~gt~~ galvinometer.

Describe

~~At~~ At Phila. last spring ~~winter~~ ~~winter~~ very careful tests were being made of the merits of electric generators. To an outsider all that there was to seen was large fires under boiling water the steam from which drove a powerful engine ~~turning~~ which by means of a belt revolved a mass of iron and copper between two masses of the same material.

~~It~~ A number of wires extend

from this place to where the observers were. All that each of them ~~was~~ was doing, was ~~to~~ to ~~watch~~ watch the movement of a ~~light~~ magnetic needle ~~in~~ surrounded by wire or to see how rapidly a body of water ~~increases~~ in which a coil of wire was ~~is~~ immersed increased its temperature.

At the Pearl St. Station in New York one sees

engines. large masses : warm wires glass globes with heated hair pins

In electrical as well as in other branches of science ~~an exact knowledge of electricity~~ ~~is~~ We must translate everything back to what we can reasonably suppose to be a true explanation.

Though we cannot see, taste, hear, smell or handle electricity as we do solids yet we can measure it. During the past fifteen years yardsticks have been ~~discovered~~ invented by means of which we can measure electrical quantities with the greatest accuracy. We find we

are dealing with an agent that is always true to its own nature.

I always prefer to think of electricity as a fluid, though I know it is not, yet such a conception seems to render it more clear in my mind.

The physical world is made up of two things, matter and energy. Each of these is so far as we know indestructible. There is every reason from analogy to think, the total amount of either of these fundamental principles is the same today as it has been for countless ages in the visible universe. Regarding their ultimate nature we know but little. We know that the two ~~elements are~~ ultimate elements are closely related by exact laws with each other. A pound of zinc is always a pound and when we burn it in any way we always find a certain amount of energy given off which ~~is~~ can be measured as well as the weight of the zinc. ty but in differents units.

Electricity as we know it generally is energy in a very agile form. ~~It~~ There are many reasons to think that it is the form in which latent energy in its ordinary state ~~is combined~~ combines with matter. When once the bond between matter and this energy is broken we find electricity distributing the energy over the surrounding medium and ~~so~~ allowing it to be given off as heat, light, motion &c.

We have in ~~it~~ electricity a servant that travels with ~~the~~ a speed approximating that of light, ~~carrying with~~ and when so travelling bring the energy of the coal or zinc that we desire to utilize and ever ready to change its form at our bidding to useful forms of work.

In reviewing the progress of man's knowledge of electricity there ~~has been of~~ are four periods of special activity. The first was about the year 1750 when the Leyden Jar was first discovered and our own Franklin proved that lightning ~~and~~ was caused by the discharge of Electricity. His ever practical sense made him apply the

X-E 62.98 7

knowledge gained in giving ~~the world~~ mankind a means to protect itself from the danger of lightning. So thoroughly good was his invention that his method stands today as the best, and it is boldly asserted, by those ~~most~~ familiar with the subject, that there never has been a case where ~~a house~~ damage was done to a structure, which had been properly ~~protected by~~ provided with lightning rods.

In passing it ~~can~~ should be said that the ordinary has all the faults glass insulators, broken joints, bad grounds.

copper rod.

These discoveries of Franklin turned the world's attention to electricity. There can be nothing more striking than the experiments made by Franklin. The character of the man, the simplicity of ~~the~~ his experiments, - flying a kite and placing a metal rod from wet ground to ~~the~~ above a structure and the results, -

The second period of activity was about the commencement of this century when the discoveries of Galvani and Volta had led to the making of batteries from which a continuous flow of electricity could be obtained. Sir Humphry Davy was one of the most prominent experimenters at this time. ~~and his~~ ~~He~~ had a very large battery built and with it he showed the electric light on a large scale for the first time. ~~It~~ ~~The beginning of most of the effects~~

X-E6298 9

The next period is ~~the~~ about 1840 when the electric ~~teg~~ telegraph was becoming general and the batteries similar ~~the~~ to those in use today were invented, by means of which powerful currents could be obtained for considerable periods of time. Electric lighting then became practical to a limited extent and a large number of inventions were then made. We find that the arc lamps then made contained many of the essential features of the present lamps.

As is generally known there are two methods &c.

Describe arc

and show

also show incandescent wire

Mr. Edison never claimed the fact of getting light by the ~~incandescent~~ ~~incandescence~~

The fourth period of activity is the present and may be said to date from the invention of the Gramme machine and the public display of electric lighting in Paris in 1878 by means of the Jablochkoff candle.

Some of you may have seen the display at that time and been rendered enthusiastic at the prospects of electric lighting. I remember well how beautiful the Avenue de L'Opera looked with the brilliant lights. ~~It was about~~ This method of lighting proved too expensive and now in Paris there are scarcely any arc lights in the streets, though in many buildings large numbers of ~~~~ ~~~~ Edison lights are in use, for example 2500 in the Grand Opera House

X-E-6298 11

The attention of capitalists was turned to electric lighting by the display in Paris and a number of New York gentlemen including ~~notably~~ Tracy ~~Edson~~ ~~Edson~~ Edson, ~~Mr. Lo~~ Grosvenor P. Lowrey Mr. Banker and several of the members of the firm of Drexel, Morgan & Co. ~~and other~~ thought that Mr. Edison reputation as an inventor justified them in putting ~~their~~ money at his disposal ~~to try and~~ to aid him in his attempts to solve the problem of making the electric light of use in household illumination.

The problem then much debated was the subdivision of the electric light. The powerful arc lights were recognized as having a limited use, and it was a great ~~problem~~ question whether electric lighting could be successfully ~~too~~ carried out, in a ~~many~~ manner similar to gas lighting, where the light is given from numerous small flames.

This was the distinct physical puzzle that was given to Mr. Edison to solve and one that was considered impossible of solution by the greater portion of electricians.

Before going further it may prove interesting to see who Mr. Edison is what he had done

Mr. Edison is a man, ~~also~~ of great intellectual power, a genius in the seeing of the best way to secure an end, and a most persistant worker.

~~I have thought one of the~~

Edison

Train boy

Skilled Operator New Orleans Memphis South during war

N.Y. Walking streets

Hand writing

Gold & Stock printers

made success out of failure

Automatic Telegraph

Electric pen

Gold medal lost on ferry

Quadraplex tel.

$500,000 saved first year

Telephone

Phonograph

In the invention of the telephone Mr. Edison ~~was put to work on the~~ started to ~~do~~ make an instrument that would carry speech by means of electricity. Any-one who has heard the story of the troubles he met with will understand how diffi-cult his task was. He gained ~~his~~ his solution by degrees reaching from one ex-periment to another by almost imperceptable steps.

6

"In the invention of the electric light he ~~has~~ constantly kept at the problem even when the solution seemed beyond reach.

I began working with him in the fall of 1878. and, I remember well the long nights during the following winter, that we worked, with only occa-sionally a ray of hope. Mr. Edison always believed in trying every experiment that could be suggested so long as it was pertinent to the inquiry.

His first experiments were devoted to trying to make ~~an platinum~~ lamps in which incandescent platinum were used to give light. He made a large number of burners with a variety of regulating devices.

He at last succeeded in giving a good amount of light from platinum, but not enough to make the lamps successful against the present form of lamps.

The ~~[illegible]~~ ultimate outcome of Mr. Edison's work is the ~~[illegible]~~ Incandescent system of lighting as at present used.

~~This consists~~ It would be too technical an account to trace the ~~[illegible]~~ invention as it was perfected in Mr. Edison's laboratory. I can only say that each part was carefully worked out in detail by Mr. Edison relying solely on his own experiments. Before he rested he had several large stations running in which the gas system of lighting was duplicated ~~[illegible]~~ each gas jet by an electric burner.

Thus not only did he subdivide the electric current in theory, but he carried the practice to the extent, that in less than five years after subdivision had been pronounced by no less a man than Mr. Preece, the electrician of the British Post Office; he was selling ~~his~~ light in numerous places at a profit."

Mr. Edison often used to say when he ~~was~~ had found anything of special merit and novelty, that in a few years many would come forward and claim that the matter was old and that there was no novelty in it. This is the case exactly, for with a complete invention well protected by patents, he finds that there are numerous Companies who are willing to take their chances ~~that that he invented~~ against it ever being held by the courts, that ~~what was unknown to him and those working with him~~, that

he invented the method of subdivision.

~~The incandescent system of lighting consists of~~

Electric light is ~~produced~~ in all cases in substantially the following manner.

The energy that is needed to ~~[illegible]~~ heat the carbon in the lamp is brought to the system in the coal that is placed under the boiler: The water is changed to steam and the energy is carried into the steam engine.

The steam engine ~~to~~ is a machine for ~~to~~ converting the energy of the steam into energy of mechanical motion. The belt carries this energy to the dynamo.

The dynamo machine ~~consists of~~ changes the energy ~~of~~ brought to it by the belt, into electric energy. This electric energy distributes itself over the net work of wires that ~~[illegible]~~ ramify over the place to be lighted in almost indentically the

same way that gas pipes ~~are carried~~ branch out. The main difference being that two wires are carried every where instead of one pipe. The outlet in a electric system, corresponding to the outlet in gas, and is a small filament of carbon placed so that the electricity will flow through it from one wire to the other. Many outlets can be placed between the two wires, as many outlets can be placed on a gas system; each system requiring that the sizes of the wires or pipes shall increase proportionally and that the supply shall be made the larger, the greater the number of lights used.

The Edison system took gas lighting as its model and adapted electricity to give light in place of gas.

The Edison lamp ~~is the~~ embodies Mr. Edison's solution to the puzzle given him in 1878 to solve.

(Maxim) The filament or thread-like carbon makes a contracted outlet for the electricity to flow from, the same as the small slit or holes in a gas jet make a very small flow of gas through the pipe.

Mr. Edison's discovery in the theory of electric lighting was that a very thin piece of carbon should be used. He perfected the methods by which this small amount of carbon could be kept from being destroyed. The only way know today is the same that he employed in 1879.

From the small glass bulb the air is exhausted, the platinum wires running through the glass to carry the current.

Enlarged ends

Lamp in two parts.

Lamps of various kinds and sizes &c

In looking forward to the future developements of ~~electric lighting~~ our use of electricity it seems to me that the next period of activity will be in the application of electric motors to commercial uses on a large scale.

The theory of the electric motor is advanced to the point that there remains nothing but the overcoming of mechanical troubles before we shall find railways driven by electricity and the electric motor a common necessity in work-shop and home.

If ~~sssst~~ ever some adventurer into the great unknown regions of nature shall ~~ever~~ discover a method by which, with economy, the latent energy of coal can be converted directly into electricity without the need of the steam engine; he will have the great reward that results from upsetting the ways of the world. Now we only get about 10% of the energy of the coal into electric energy, the other 90% is wasted. If coal could be burned as economically in respect to energy as zinc can be burned in batteries these figures would be reversed and we would only waste 10%.

Then we may imagine all railroads and mechanical powers driven by electricity, we would find ~~at~~ near the coal mines great generators and reaching over the land, as now the pipe lines for oil reach over the land, conductors of such form that the electricity can be carried by them.

X-E62-85-9 (1886)

Lamp Co. Circular

The Edison Lamp Co. started in 1880 at Menlo Park as a partnership composed ~~with Mr.~~ of Mr. T. A. Edison and ~~with~~ some of the men ~~that~~ who had been with him in his laboratory. At the time everything was new and ~~untried. The~~ and no methods or tools existed ~~for~~ carrying on the business ~~thereon~~. The Edison Electric Light Company of New York were anxious at the time for the sake of helping ~~out other~~ the business of lighting from Central Stations to be able to fix a price at which lamps could be sold. This The Edison Lamp Co. agreed to do and

X-E62-85-9 2

sold to the Edison Light Co. a large number of lamps at a fixed price, which was for two years below the cost of production.

In 1881(?) the factory was moved from Menlo Park to East Newark N.J. The business had grown then beyond the ability of the neighborhood of Menlo Park to supply the help required.

In 1882(?) the present corporation was organized taking over the rights and contracts of the partnership.

The Edison Lamp Co. now have the largest works of the kind in the

world. The second in size being the Edison and Swan Co's factory in England who manufacture ~~the~~ ~~at~~ ~~the~~ ~~Edison Swan~~ for the Edison-Swan United Company of London. They make about one third as many lamps as the Edison Lamp Co.

The factory is on a ~~square~~ rectangle of land ~~cov~~ covering a whole block about 3 acres in all. ~~It~~ ~~The~~ The entire energy of a large force is directed ~~entir~~ wholly to making Edison Lamps and volt indicators in which lamps are employed.

A large staff of workmen are constantly employed under the supervision of Mr. J. H. Edison in person in experimenting on processes by which the lamps can be improved.

This is claimed as the result of all this care: That for commercial lighting in all its various needs the Edison Lamp as made at the factory of the Edison Lamp Co. is the best now made.

Mr. Edison having his laboratory in ~~the~~ one of the buildings of the Company is ~~a~~ daily at the factory and thus gives to them the benefit of his wide ~~ex~~ experience.

X-E62-85-9 5

~~Our Edison Lamps~~

It is not claimed by those competent to make claims that Mr. T. A. Edison discovered that light could be obtained from incandescent carbon

FRANCIS R. UPTON COLLECTION

1887

X-E628VF19

At Sea Jan 5, 1887.

Edw. H. Johnson Pres:

Dear Sir:

Regarding the Ziperrowsky tests. I arranged on my visit to Rome and Milan that Lieb should make the tests you desire under the contract.

He can do this the latter part of this month if ~~we~~ you notify him

I found at Rome a station running about 600 Edison Lamps and 40 arc lamps. The building is in

the yard of the ~~ga~~ Gas Company and is erected for a capacity of 12,000 Lamps. Prof. Columbo told me that the boilers for 6000 lights were on the way and that ~~that~~ the machinery had been ordered.

The lighting is distant about one mile from the station and the light appeared to be successful. I did not make any tests, but was much impressed by the evident careful working out of details shown in the whole installation.

There was a distinct impression made that such a system would be a very dangerous competitor to the Edison system, as it could do lighting on a very large scale with a moderate investment in conductors.

The plant in Rome uses the coke from the gas works under the boilers as fuel.

The using of such high tension currents makes the inside wiring of the station very simple

The engines were working badly when I was at the station so that it was impossible to get any tests.

Lieb can make the tests needed better than I could. After what I saw I do not think that we need tests to ~~hold~~ show that the Edison Co should hold to the Zipernowsky system. The station showed ~~a~~ such thorough work leading to results wanted that the Edison Company will keep a dangerous enemy out of the field.

Yours Francis R. Upton

X-E6285-9

Edw. H. Johnson Pres

E 6285-12
1887-01-10
1886-12-13

The Edison System of Central Station Lighting.

Edison Electric Light

Company,

Nos. 16 and 18 Broad Street,

New York City.

HOWELL'S ARTICLE, "FUNCTIONS OF NEUTRAL WIRE IN THREE-WIRE SYSTEM."

ENGINEERING DEPARTMENT.

EDISON ELECTRIC LIGHT CO.

16 AND 18 BROAD STREET,

NEW YORK, JANUARY 10, 1887.

At the semi-annual meeting of the Association of Edison Illuminating Companies, held in August, 1886, the great importance of maintaining a perfect balance in the three-wire system was a subject of discussion.

In order that proper and constant attention should be given to the matter, a resolution was passed requesting Mr. John W. Howell, the Electrical Engineer of the Edison Lamp Company, to write an article on the subject.

Mr. Howell has kindly prepared the following paper, which we now place before our central station companies.

Very respectfully,

EDISON ELECTRIC LIGHT CO.

THE FUNCTIONS OF THE NEUTRAL WIRE IN THE THREE-WIRE SYSTEM.

The weight of copper necessary to carry a given amount of electrical energy a given distance with a given loss varies inversely as the square of the e. m. f. employed. Thus the copper necessary to run a number of 100-volt lamps at a given distance would be four times as great in a simple multiple arc system as it would be if we use 200 volts and run our lamps 2 in series. The percentage of loss being the same in both cases.

The Edison "3-wire" system combines to a large extent the advantages of both these systems. Each lamp is controlled independently, as in the simple multiple arc system, and the copper is reduced nearly to the amount required in the 2 in series system. The amount of copper it requires in excess of the 2 in series system is the amount used in the neutral wire. What is this amount? What conditions determine it, and what influence does this wire have upon the system?

Let us first see what function this wire performs.

In any service (as a store), if more current is used from one side of the system than from the other, the excess is carried to or from the mains in the street by the neutral wire of that service. These neutral currents flowing some one way, some the other, tend to balance each other. Thus one flowing outward in a service flows through the neutral main to some other service, where it flows inward, where it passes through the lamps and back to the station through the outside wire.

If in a given section the sum of the outward flowing currents exceeds the sum of the inward flowing ones, or *vice versa*, the

excess is carried to or from the station by the neutral wire of the feeder supplying that section. These neutral feeder currents either balance each other in the "bus" or the excess one way or the other shows how much more current is being used on one side than on the other.

Having traced the course of the neutral currents through the system, let us see what effects they produce. Consider the mains at a feeder end, a point at which regulation is performed. Let the potentials at this point be 210,110 and 10, with no current flowing in the neutral wire. Now, suppose a current flows in our neutral feeder toward the station, causing a drop of two volts. Then the neutral potential at that point will be 112, and our pressures will be 98 and 102, instead of 100. Thus a drop of two volts in our neutral feeder causes a difference in pressure of four volts between the two sides.

We have control of our positive and negative potentials, and if now, by our equalizers, we make our positive and negative potentials 212 and 12, we will still have a pressure of 100 on each side. Thus by our equalizers we can counteract the bad effects of currents in our neutral feeders; but it requires a capacity in our equalizers in excess of that required to adjust for changes of load on that feeder without neutral currents.

Now, consider neutral currents in our main.

Feeder.		Mains.	
	212.........3 volts loss.......209		
F. Positive	————————————————	L. Positive	
	112.........1 volt loss... ...113		96
F. Neutral	————————————————	L. Neutral	
	12.........2 volts loss....... 14		99
F. Negative	————————————————	L. Negative	

F positive, F neutral, F negative shows the points on the mains where a feeder ends; suppose our potentials at this point

to be 212, 112 and 12, a difference of potentials of 100 being maintained by our equalizers, our mains being all three the same size, suppose a load to be on our positive side large enough to cause a loss of 3 volts in this positive main, making a potential of 209 at L positive. Now suppose the negative side has load enough to cause a loss of 2 volts in this negative main, making a potential of 14 at L negative. The excess of current being used on the positive side will flow through the neutral wire and will in this case cause a drop of 1 volt in this wire, making the potential at L neutral 113; thus at L we have a pressure of 96 on the positive side and 99 on our negative side, a difference of 3 volts, caused by one volt loss on our neutral mains, and any loss on our neutral main causes three times that much difference between the pressures on our two sides at the low point. The pressures at feeder end being kept constant.

Thus we see that neutral currents anywhere in our system have a very bad effect upon our regulation; in the feeders these bad effects can be entirely remedied if we have capacity enough in our equalizers, but the mains beyond the feeder ends are entirely beyond our control with our present apparatus, and to prevent the bad effects of neutral main currents, we must prevent the currents flowing or make our neutral main so large that the neutral currents will not cause an appreciable loss.

Suppose with full load we have a loss of 5 volts on our mains. Let one side have the full load on and the other side have four-fifths load on; now the difference being carried through the neutral main will cause a loss of one volt in the neutral main and a difference of 3 volts between the pressures on the two sides at the low point. Now, suppose we have 2 volts loss on our mains with full load; let one side have full load on.

Now, keeping full load on one side it will be necessary to throw one half the load off the other side to make a loss of one volt in our neutral main, the same neutral loss that was caused by one-fifth the load, being off one side in the first case, requires one-half the load to be off in the second case.

This shows the very great advantage in using heavy mains. However, "prevention is better than cure," and the best way to get rid of the bad effects of neutral currents is to get rid of the neutral currents themselves; there is only one way to do this, and this is, BALANCE EACH SERVICE INDEPENDENTLY; wire each customer on the 3-wire system so that under his usual conditions his load will be half on each side, and his throwing on or off his lamps will not affect the balance; all stores and large consumers can be readily wired in this way, and, indeed, all customers can be, by using a very little judgment in laying out the work.

Not only should this be done, but in dwellings or other places where different groups of lamps are used at different times, each group should be wired to preserve a balance. All high candle power lamps and all motors which take a large amount of current and are hard to balance should, in my opinion, be made to operate with 200 volts, and be used between the outside wires.

Under these circumstances we have the nearest possible approach to a perfect system, and, if carried out, we can not only very greatly improve our distribution, but we can also with safety reduce the size of our neutral wire in mains which are figured for a small loss.

This system of wiring also gives you the additional satisfaction of knowing that an accident to your A or B side will only put out HALF THE LAMPS OF EACH CUSTOMER, AND NOT ALL THE LAMPS OF HALF YOUR CUSTOMERS.

Since neutral currents do exist in our mains, and are likely to exist, we must get them out of the mains where they are beyond our control, and into the feeders where we can control them, as soon as possible; so it is advisable to have a neutral wire in each feeder, in order that the neutral currents can be led away from the mains and into the station before they have traveled any distance in the mains; the further a current travels the greater the loss it occasions, and in this case the

greater difference in pressures it occasions between the two sides.

Therefore, in a well-balanced system, although we may reduce the size of our neutral feeder-wires as well as our mains, still it is strongly advisable to keep a neutral wire in each feeder.

Wherever the mains are "bridged" a neutral bridge should be put in as well as a positive and negative one.

A very marked case of bad balance due to neutral currents came under my observation once; a service ran from a feeder end back to the station; the lamps in the station were all in multiple arc, with a pole-changing switch for throwing them on the positive or negative side from the station when the neutral ampère meter showed a bad balance.

Feeder.

Positive, 240 ....3 volts loss............ 237

109

Neutral, 125 ....3 volts loss............ 128

118

Negative, 10 10

I could measure the pressure at feeder end and also on both sides of the station service. Not only did we get a difference of 9 volts on the two sides, when the load was all on one side, but the pressure IN THE STATION on the side having no load was 3 VOLTS HIGHER than it was at the FEEDER END ON THE SAME SIDE.

On another occasion where the neutral wire was used to carry the current for a street-lighting system, a difference of 14 volts was observed between the two sides at one point. These are extreme cases, but they show what neutral currents WILL DO.

JOHN W. HOWELL.

East Newark, N. J., December 13, 1886.

X-E 6285-TD
1887-05-23

The American Institute of Electrical Engineers,

Office of the Secretary, 16 Dey St

New York, May 23d 1887

Mr Francis R. Upton

Dear Sir.

I beg to inform you that upon the recommendation of Mr Chas L. Clarke you were duly elected to associate Membership at a special meeting of Council held May 17th

Yours truly

R. W. Pope

Secy

X-E6285-6
(1887)-07-14

June 14

Dear Upton
A letter to
Pontifex one to a jolly
good fellow & cousin
of mine Richard Hewitt
whom I advise you
to look up early on
arrival, he is in with
all the great Brewers
who will want Telemeters
My name as a
Life Member at the
Army & Navy Stores (
on Regent St) will
be your pass word
do what you like there

receipt to run me in
debt for an amt greater
than the Capital Stock
of [illegible] Co. If my
friends give you
good dinners remember
me. Knowing that I
can hit back if I
have the chance.
Good luck to you
& [illegible] best me to
a cable if you
make a million or
more, so I can be
on the dock to receive
you & help you
take care of it.

With best wishes
& regards to friends
Believe [illegible]
[illegible] truly
R Hewitt

X-E62856

F. R. Upton Esq
Present

X-E6285-6
1887-07-14

July 14-1887

My dear Richard

A line to introduce my friend & Co-director Mr F R Upton Wreath of the Telemeter Co. of NY. You will find the gentleman one of our brightest active "Yankees". he goes to London on business & may require a Ship to bring back a cargo of the coin of the Realm if he does & requires any assistance just telegraph to me & I will come over

X-E6285-6

Sorry to miss you — Am leaving for Cologne tomorrow today or Sunday. — will try & call again ——

& help him & see you at the same time.
Seriously, I bespeak your friendly acquaintance for my friend and remain Very truly
Your friend & cousin
Robert Hewitt

To Richard Hewitt Esq

X-E6285-6

Richard Hewitt Esq
No 15 Harewood Square
London
Eng

Introducing F.R. Upton Esq
of New York

X-E62 85-6

NY July 14/87

H F Gillig Esq
Manager of Amr Exchange
London

My dear Mr Gillig

As you know more good fellows than any man I ever met. I want to add just one more to your list, my friend Mr F R Upton of the "Edison Co." & also Vice Prest of the "Telemeter Co." he knows many of your friends

here & with these
few lines I place
him in your hands.
If you have not
forgotten me since last
we met, Believe me as always
Yours sincerely
Robert Hewitt.

X-E6285-6

H. F. Gillig Esq
American Exchange
London
Esq.

Introducing
F. R. Upton Esq
of New York

X-E62856
1887-07-14

New York July 12/87

E A Pontifex Esq
London

My dear Mr Pontifex,

Allow me to introduce to your acquaintance my esteemed friend, Mr. J. R. Upton, the Vice Presdt. of the Telemeter Co. Mr Upton will inform you how important Telemetry is to the "Pontifex Co." & as he visits your city to meet some

prominent gentlemen
who are interested in
this matter. I should
esteem it a personal
favor if you can
have him meet some
of your great Brewing
Firms who would I
know be interested
in seeing or knowing
about "Telemeter" -
To day as I write this
one of hottest days,
thermometer 92° the
Brine leaves the Pontifex
Machines at my stores
at 4° & I have
rooms at 9° a little
more work like this

& you may expect
my to visit your
City in a year or two
on even a pleasanter
mission than when
I first met you.
Bespeaking for my
friend your polite
attention Believe me
Yrs truly
Robert Hewitt.

1887-07-14
Bry Hewitt
X-E6285-L

E. A. Pontifex Esq
Shoe Lane
London
Esq

Introducing
F. R. Upton Esq
of New York

X-E6298
1887-07-15

Llewellyn Park
Orange N.J. July 15th 1887

To my European Friends:

It gives me much pleasure to present to you Mr. Francis R. Upton, the bearer of this letter, who goes to Europe for a brief season. Besides being my personal friend Mr. Upton has been closely associated with me during the past nine years in both the technical and commercial development of my Electric Light inventions, and in commending him to your kind consideration it is with the feeling that I will share in his gratitude for any Courtesies you may extend.

Yours Very truly

Thomas A Edison

Cable Address, BAMBOO, Newark, New Jersey.

EDISON LAMP COMPANY,

CAPITAL, $250,000.00

FRANCIS R. UPTON, Gen'l M'g'r and Treas.

X-E6285-9
1887-08-19

EAST NEWARK, N. J. Aug 19 1887

My dear Mr Upton:

When I left you on the Fulda I went down to the Westernland and found they could use the lamps we had in stock so we sent them what they wanted. I suppose you want to know all about the "new lamp". Those at New Brunswick will give over 1000 hours life. The Engineering Dept test will not show as well but they have a poor engine and cant keep a steady pressure; The 20 we set up here are giving good life. I set up ten of the "very latest" which gave the best record in the test room; they are doing well for life but the c.p. is down the fall in c.p. is very little better than 10 c.p. lamps at 16. giving about the same economy. The loss of c.p. in the 20 being tested in my room is too great to be satisfactory. Vail wrote some asking for a paper on the new Lamp to be read at the Meeting of the Assn at Altoona which was held a week ago. Edison said go ahead and write them a paper. I didnt care to state the facts of the case so didnt write a paper but when it was

called for I got up and talked about it giving an account of what "Edison says" about it. I said a good deal about Mr Edison's wonderful inventive faculties, much about the great benefits of a 15 to the H.P. lamp and gave them the results of our N.B. and N.Y. tests. then I told them the close regulation required by the new lamp and told them they all had a good deal of work to do before they could use the new lamp to advantage. The result is every body wants to have their systems fixed up so they can get the new lamps. I read a paper at the meeting on Lamp breakage its causes and their remedies — We got up a regular boom for good regulation and everybody is going to put their station in A No 1 order. The association appointed a committee to report upon the best methods of putting the old stations in good shape they are to meet soon and start the good work and I hope they will accomplish something. This subject is worth all the attention it received, without considering the new lamps at all. The whole meeting was a very enthusiastic one there was only one kicker — Mr McKeesport who is a chronic kicker — Mr McLaughlin of Detroit got up and said the Westinghouse Co were coming into his territory and as he had bought the Edison System on the representation that it was a monopoly he called upon the Edison Co to protect them from competition. A man from Columbus O. said the same thing, he wanted protection and wanted to know what the Edison Co was going to do about it. A New Orleans man voiced the same sentiments. There was a meeting in the camp every body was jumping on the Edison Co for not protecting their patents. When they got a little quiet Mr Johnson got up and made a fine speech showing what the Co. had done on their patent suits and how everything that they thought best had been done, he made a fine showing of the case and every man who had asked for protection was thoroughly ashamed of himself. The association then passed a resolution endorsing the course of the Edison Co in this matter, stating that the Co had acted entirely in the best interests of the Ill. Cos. and that they would stand by the Co in the fight to the end. We gave the Assn. $100 as did each of the Manufacturing Cos — We were thanked for taking off the charge for packages & Bergman was asked to do likewise

The Edison Co of Phila is going ahead vigorously Prof Marks is Supervising Engineer which be

means the Poo Bah of the Co. I stopped over night with him on my way from Altoona. He is giving his whole time to the work and intends to have a first class station and system - he ordered his mains of Kruse to be 1½% loss with full load. Kruse and Callender are working for the feeders. Prof Anthony has resigned from Cornell to be manager of the Mather Co. Dr Nichols, our old friend has been appointed his successor at Cornell. Everything is running smoothely here - Edison promised many parties new lamps by Aug 1st and he is daily reminded of the fact that they are not being shipped - he is mad because they are not ready. They look like the old 5½" 10 c.p. lamps. Holzer is so very pleasant that he excites my suspicions. Clemmock offered Jackson the position of Electrician to the U.M.Co but Jackson preferred to remain here. We brought up the last of the old indicators today and will commence on the new ones soon, the new ones are very nice instruments. Bradly had to hurry through 50 new ones for us.

With regards to Dyer and best wishes for your success in your enterprize

I am Yours

John W. Howell

X-E6285-6
1887-08-29

TELEPHONE Nº 2648. ESTABLISHED A.D. 1825. TELEGRAMS, "ELECTROLER", LONDON.

B. VERITY & SONS, KING STREET,

ARTIFICERS IN BRASS, ELECTRIC LIGHT ENGINEERS AND CONTRACTORS.

COVENT GARDEN,
(ONLY ADDRESS)

LONDON, Aug 29 1887

Dr. E. Hopkinson

Dear Sir

May I have the pleasure of introducing to you Mr. Francis R. Upton.

As he is the managing director of the Edison Lamp Company and intimately associated with the Electric Light industry in America you will be enabled to hear of the latest developments that are there taking place.

Any assistance you can render him so that he may see the factories that have made Manchester so famous abroad will be very much esteemed by

Yrs Sincerely
Alan B. Verity

Introducing Mr Francis R. Upton.

X-E6285

By hand 1887

Dr. Edward Hopkinson
Messrs. Mather & Platt
Salford.
Manchester.

X-E62856
1887-08-29

TELEPHONE Nº 2648. ESTABLISHED A.D. 1825. TELEGRAMS, "ELECTROLER", LONDON.

B. VERITY & SONS,
KING STREET,
ARTIFICERS IN BRASS,
ELECTRIC LIGHT ENGINEERS
AND CONTRACTORS.

COVENT GARDEN,
(ONLY ADDRESS)

LONDON, Aug 29 1887.

Messrs Crossley Bros.

Gentlemen

May I have the pleasure of introducing to you Mr Francis R. Upton one of the most prominent men of the Electric lighting industry in America.

Any assistance you can render him so that he may visit important works & factories in your neighbourhood will be much esteemed by my firm

Yrs truly

John B. Verity

Introducing Mr. F. R. Upton.

Private

By Verity 1887 X-E6285

Messrs Crossley Bros.
Openshaw
Manchester.

X-E6298
1887-09-17

Società Generale Italiana di Elettricità
Sistema Edison

DIPLOMI D'ONORE
Espos. di Parigi 1881 _ Espos. di Torino 1884.

Società Anonima
Capitale L. 3.000.000. interamente versato.

Rappresentanza
del Sistema
ZIPERNOWSKY-DÉRI

Per telegrammi: EDISON. MILANO.

Milano, Sept 17th 1887
Via A. Manzoni 12 A.

My dear Mr. Upton;

While I was at Budapest a few months ago on business connected with the Transformer plant for our Station Mess. Ganz & Co expressed an earnest desire to be able to communicate with you and were glad to hear from me that you expected to be in Europe soon. Having heard of your arrival Mr. Zipernowsky telegraphed me inquiring if it would be possible to arrange a meeting with you in Paris which explains the interchange of the several despatches between us. I hereby confirm my last despatch to Dyer for you:- "Zipernowsky will see Upton Paris Monday. Zip stops Hotel Pavillon Rue l'Echiquier. Lieb"

At the same time I Telegraphed Mr. Zipernowsky the contents of your despatch: "Will be in Paris Monday, Tuesday, Wednesday next week Hotel Chatham."
Mr. Zipernowsky replied that he would be in Paris Sunday.
I was glad you wrote a letter to the Prof. explaining the "economic lamp" question. When he was last in Paris he was told the Lamp was already on the market but I assured him such was not the case as I knew from reports recently received from America.
The Deutsche Edison Gesellschaft seems to be casting its eye in this direction.
It would be a good thing if you could come to some understanding with Zipernowsky to enable the Edison Company to give the System a trial in America.
They are greatly in need of it to compete with Westinghouse who seems to be making immense strides.
A recent letter from a friend occupying an important position with one of the largest Western Local Edison Companies says:- They (the Edison Co) need something to show in competition with W. - As it is they have

X-E6298
1887-09-17

Società Generale Italiana di Elettricità Sistema Edison

DIPLOMI D'ONORE
Espos. di Parigi 1881 _ Espos. di Torino 1884.

Società Anonima
Capitale L. 3.000.000. interamente versato.

Rappresentanza del Sistema
ZIPERNOWSKY-DÉRI

Per telegrammi: EDISON. MILANO.

Milano, ______ 188_
Via A. Manzoni 12 A.

nothing and so they cannot (and so we cannot) come in the field against him, in long distance lighting. He has already taken several stations that would otherwise have been ours."

I was sorry to hear that you thought it would be impossible for you to come to Milan on this trip but hope you may still be able to visit us.

Mrs. Lieb & myself thank you very much for your kind congratulations and I am glad to say that both Mama & the Baby are doing splendidly.

With highest regards from Mrs. Lieb & hoping we shall see you soon in Milan I am

Yours sincerely
J. W. Lieb

PLEASE ADDRESS
J. W. LIEB
4. VIA S^A RADEGONDA
MILAN

X-E-6-2-98.

Cleveland, O. Nov 16th 1887

Shipped by **THE NATIONAL CARBON CO.,**

On the Union Line Railroad,

In apparent good order, except as noted, the packages described below (contents and value unknown) marked and consigned as indicated, which said Company agrees to transport with as reasonable dispatch as its general business will permit, to destination, if on its road, or otherwise to the place on its road where same is to be delivered to any connecting carrier, and there deliver to the consignee or to such connecting carrier, upon the following **TERMS AND CONDITIONS**, which are hereby agreed to by the shipper, and by him accepted as just and reasonable, and which are for the benefit of every carrier over whose line said goods are transported: **1st.** Neither this Company, nor any other carrier receiving said property to carry on its route to destination, is bound to carry the same by any particular train, or in time for any particular market, and any carrier in forwarding said property from the point where it leaves its line is to be held as a forwarder only. **2d.** Neither this Company nor any such other carrier shall be liable for any loss of or damage to said property by dangers or accidents incident to railroad transportation, or by fires or floods while at depots, stations, yards, landings, warehouses, or in transit. And said property is to be carried at owners' risk of leakage, breakage, chafing, loss in weight, or loss or damage caused by changes in weather, or by heat, frost, wet or decay, and if any portion of its route to destination is by water, of all dangers incident to navigation. **3d.** Responsibility of any carrier shall cease as soon as said property is ready for delivery to next carrier or to consignee, and each carrier shall be liable only for loss or damage occurring on its own line; and in case of loss of or damage to such property for which any carrier shall be responsible, its value or cost at time and place of shipment shall govern settlement therefor, unless a value has been agreed upon with shipper, or is determined by the classification upon which the rate is based. And any carrier liable on account of loss of or damage to such property, shall have the benefit of any insurance effected thereon by or on account of the owner or consignee thereof. **4th.** Such property shall be subject to necessary cooperage and baling at owner's cost. And if the owner or consignee is to unload said property, the delivering carrier may make a reasonable charge per day for the detention of any car after the same has been held twenty-four hours for unloading, and may add such charge to the freight due, and hold said property subject to a lien therefor. **5th.** Grain in bulk consigned to a point where there is an elevator may, (unless otherwise expressly noted herein, and then if it is not promptly unloaded) be there delivered, and mixed with other grain of same kind and grade, without respect to ownership, and if so delivered shall be subject to elevator charges in addition to the charge for transportation. **6th.** Any carrier over whose route Cotton is to be transported hereunder, shall have the privilege, at its own cost, of compressing the same for greater convenience in handling and forwarding, [illegible] for unavoidable delays in procuring such compression. **7th.** Property to be delivered at any switch or station where the carrier [illegible] shall be at the owner's risk from the time it is ready for delivery. **8th.** No carrier hereunder shall be liable on account of the wrong carriage or delivery of property marked with initials or by numbers only, or otherwise incorrectly or illegibly marked. **9th.** Owner or consignee shall pay at the rate below stated freight charges before delivery, and according to weights as ascertained by either carrier. **10th.** Any claim for total loss of property received hereunder shall be presented, together with this contract, within ten days from date hereof, and any claim for partial loss of any such property or damage thereto, shall be presented within twenty-four hours after delivery of said property to consignee, and the omission to so present such claim either for loss or damage, shall be a waiver thereof, and no action shall be brought against any carrier for any alleged liability hereunder, after one year from the date hereof. This Company guarantees the through rate of freight named below.

MARKED.	ARTICLES.	WEIGHT.
Edison Lamp Co		
Harrison		
N.J. 6		
	1 Bbl Carbon	200
	ELECTRIC LIGHT CARBONS.	

Stamp: [illegible] Cleveland O. [illegible] 9 P.M. 1887 Alex Bruce, Agt. By [illegible]

THIS STAMP RECEIPTS FOR FREIGHT BUT NOT FOR RATE.

X-E62859
1887-11-28

THE EDISON LAMP CO.,

Harrison, N. J., Nov. 28, 87 188

Dear Mr. Edison:-

That the full measureof responsibility may be put upon the party to whom it belongs in the matter of the delay in the order for the Westinghouse converter, I am willing to take the entire blame on myself. I am strongly in favor of the general proposition that you should experiment on the converter, and that a converter should be made by the Edison Machine Works and offered through outside parties, or even by the United Co. or the Edison Co. I urged to Mr. Chinnock that the method we were pursuing was wrong; in getting a Westinghouse converter as a starting point for your work, and getting it in the way proposed, so that so many parties would know of it. I considered this a mistake, as it would give the Westinghouse Co. an opportunity of proving that you brought their converter into your Laboratory and took it as a starting point for experiments. It is a matter more of pride, possibly, than anything else, that I desire that your work on the converter should go forward, at first, on an independent basis. It came very vividly in my mind at the time I spoke to Mr. Chinnock, that the Westinghouse Co. in suing the Edison Co. would be

able to ask the question of you: "Did you not commence a series of experiments regarding the converter system by the purchase from us of an alternating machine with converters?"

I make this explanation that you may understand that my opposition to the purchase of a converter was entirely due to the method proposed of carrying on the experiments, while recognizing the great need at present of a competitive converter system to offer to the public. There was no thought in my mind of thwarting you, or opposing your desire to experiment; I only thought it was a wrong way to go about the matter.

Yours truly,

Francis R. Upton

Thomas A. Edison, Esq.

X-E6298
1887-12-02

THE EDISON LAMP CO.,

Harrison, N. J., ~~Dec. 2, 87.~~ 188

Thomas A. Edison, Esq.,

Upton

Dear Sir:-

Stern & Silverman requested the United Co. not to put the new lamp in a plant they have contracted for in one of the newspapers in Pittsburgh, as it was not satisfactory. We telegraphed them for their reasons for thinking that the new lamp was not satisfactory, and received the enclosed reply, which you will kindly return to us.

Yours truly,

ISON LAMP COMPANY

Francis R. Upton

TREASURER.

Write them that there is a mistake
somewhere - they must not condemn
so quickly but go into the
matter deeper se that the
Volts are right = Explain their
Theory about difference power is wrong
that the 20 cp new lamp might
suit better where power is cheap

[ENCLOSURE]

X-E6298
1887-11-30

OFFICE OF

STERN & SILVERMAN,

AUTHORIZED AGENTS AND CONTRACTING ENGINEERS

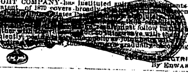
FOR

EDISON INCANDESCENT ELECTRIC LIGHT.

Nos. 1 & 2, Excelsior Building, Cor. Grant St. and Sixth Ave.

The Company's Card to the Public.

THE EDISON ELECTRIC LIGHT COMPANY has instituted [illegible] against its infringers. Mr. Edison's carbon filament patent of 1879 covers broadly [illegible] lamp. The claim that this patent has ever been in litigation [illegible] States [illegible] In Germany and England this fundamental patent has [illegible] the fact that Mr. Edison's great invention has been now [illegible] must follow [illegible] United States. The straining and distorting of these facts, together [illegible] to interfere with the [illegible] certain minor and irrelevant cases for the purpose of fraudulently [illegible] Edison in the fruits of these patent decisions only indicate th[illegible] gradually [illegible] environed by due process of law.



[illegible] ELECTRIC LIGHT COMPANY,
By EDWARD H. JOHNSON, President.

Telephone 1419. Pittsburgh, November 30 1887

Edsion Lamp Co

East Newark, New Jersey

Gentlemen:-

your telegram of even date received and in answer thereto would sy say that although our experience with the new lamp has been but slight still it has been sufficient for us to say thatb we by all means prefer the old lamp. The new lamp may measure sixteen candle power, photometrically, but the area of illumination had from the same is very much smaller and less than with an old lamp. In plainer words it is less diffusive. It is about the same as the Westinghouse Inductorium lamps, and they are unsatisfactory. Economy in steam power is not the most desirable thing in this natural gas country. Power virtually costs nothing except the interest on the investment of the steam plant, and consequently the only remaining ele ment of cost in the maintenance or operation of a light plant here would be the lamps (their length of life) A great deal of light and long life are the essential requisites here When you accomplish this for little cash outlay you will have reached perfection.

[ENCLOSURE]

X-E6298
1887-11-30

We have placed two plants with the new lamps, and in both cases the purchaser is dissatisfied. One of them remarked that he did not see the difference between it and the Westinghouse lamp. and frankly speaking we do not either. It looks to us as though the new lamp was about the same thing as a ten candle power run up to 16

And unless we can give a better lamp than the Westinghouse people we can do but little business, because they offer plants for much less money than we can buy them of you.

Respectfully Yours

X-E6298
1887-12-13

December 13, 1887.

Holzer,-

I have received a letter from Mr. Edison, which I attach. You will take his remarks regarding reversing the current, starting with "<u>On the whole I advise</u>," as orders for running the Pump Room, and see that the Pump Room is arranged so as to run lamps with the reverse current. Kindly return Mr. Edison's letter to me, with any remarks that you may make.

This matter has been brought to Mr Edison notice whilst he had his Laboratory at Lamp Factory. The matter fully explained he claims the [illegible] current to do the work [illegible]

EDISON LAMP COMPANY,

Treasurer.

[ENCLOSURE]

X-E6298
1887-12-09

THE EDISON LAMP CO.,

Harrison, N. J., Dec. 9, 87. 188

Upton - The cause of arcing is due to crystals of Sulphate of Copper on clamp near hot part of Carbon or on Carbon itself

Thomas A. Edison, Esq.,

Dear Sir:-

The cause of arcing on new lamps will be one of the clamps not got hot.

In the Testing Room to-day there has been several cases of lamps arcing. In looking over the Pump Room records I find a number of lamps arcing, more than should. Mr. Saxelby feels that the new clamp working only with one current in one way does not have all the gas taken out of it, and that when the current is reversed afterwards that it will make an arc. The arcing of lamps in practice is one of the most serious faults that can occur. A case was brought to my notice where a lamp was placed over a printing press in the "N. Y. Evening Post" office, and which arced. The proprietor of the journal ordered the whole plant taken out, as he said it would spoil his presses if the glass got into them. This was remedied by putting plain glass shades over all the lights, making a very clumsy fixture. There has been other instances in the N. Y. Station, when starting new installations, ~~and~~ where one or more lamps have arced as soon as the light was turned on. We would like your opinion as to the cause of the arcing, and the remedy which we should apply. Yours truly,

Francis R. Upton

[ENCLOSURE]

There are two ways of stopping this 1st Reversing lamp on pump — or heating clamp by a flame after it is so perfectly dry. Reversing lamp for an instant would probably be better = as at high C.P. the clamp is brought to red or white heat almost instantly — Baking the lamps for 1/2 hour at 800 or even 750 ought to ~~form~~ Carbonize the gelatin in the paste

~~You shou~~ Force tells me he touches the clamp with a flame but I consider this a dangerous practice, on the whole I advise that when you reach such an Exhaustion as to work the ~~pump~~ Lamp up high to heat the clamp that you alternate one instant on 1 clamp the other on the next & in this way work out air on both simultaneously then work blue off on one clamp only a very simple plain switch could be made or you could work a whole row and work high then reverse the whole row & work high this would dispense with many switches

Edison

X-E6285-8
(1887)

From the Laboratory
of
Thomas A. Edison.

Orange, N.J., ________ 188

Upton =
Ascertain if you
Can telegh money to Payne
in City of Mexico

Edison

FRANCIS R. UPTON COLLECTION

1888

X-E6288-9
1888-01-21

EDISON LAMP COMPANY.

THOMAS A. EDISON, President.
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

HARRISON, N. J. Jan 21 1888

Memo of Amt invested
by Mr. T. A. Edison
Cash $114.107

Per contra
Received by him

Dr Cromwell	$14000
Bradley	1879
Lawson	1879
Howell	1879
~~Hayes~~	1879
Insull	6000
	27516
Dividends	41775
	69.291
Cash invested	114.107
	69.291

Stands today to $44.816
Mr. Edison

X-E6285-9

1888-08-01

Edison Lamp Company.

THOMAS A. EDISON, President.
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

Harrison, N. J., Aug 1, 1888

Dear Mr. Edison:

Regarding Carbonizing.

I recommend that the entire preliminary be done at Bloomfield and the finish here.

It will be very difficult to keep matters quiet where so large power is needed as is the case for the final heats. There will always have to be mechanics and outsiders employed.

Whereas if the preliminary alone is carried on it can be kept absolutely quiet.

The Sawyer-Mann Co. knows that do something in the house in the yard but have

X-E6285-9.
1886-08-01

Edison Lamp Company.

THOMAS A. EDISON, President.
FRANCIS R. UPTON, Gen'l M'g'r & Treas.

Harrison, N. J., ...188

yet found out what.
From ~~fibres~~ carbons before and after dipping a good guess could be made.

If you agree with me Martin can go to Bloomfield and all Lawson's ovens be sent there quietly via the laboratory.

Yours
Francis R. Upton

THE EDISON LAMP CO.,

X-E6298
1888-09-19

Harrison, N. J., Sept. 19th, 1888

I, Thomas A. Edison, owning in my own name, upon the books of the Company a majority of the Stock of the Edison Lamp Co. hereby consent to the transfer of Certificate No. 27 for 25 Shares, to the Third National Bank of the City of New York, or any one whom they may direct, waiving all my rights under Section 2, Article 10 of the By-laws, as regards said transfer.

Thos A Edison

X-E 62-98
1888-10-04

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

(FOUNDED 1884.)

EXECUTIVE OFFICES, TEMPLE COURT, 5 BEEKMAN STREET.

EDWARD WESTON, PRES'T., 645 HIGH ST., NEWARK, N. J.
GEORGE M. PHELPS, JR., TREAS, 11 WALL STREET, N. Y.
RALPH W. POPE, SEC'Y., 5 BEEKMAN STREET, N. Y.

In reply to your letter of..........................

New York, Oct. 4th. 1888. ~~188~~

Francis R. Upton, Esq.
East Newark,
~~Harrison~~, N. J.

Dear Sir:

At the regular meeting of Council held Oct. 2d. the following named gentlemen were appointed to serve as additional members of the Committe on Permanent Quarters.

Francis R. Upton

Thomas A. Edison

The committee will hereafter be known as the Committe on Finance, Buiding and Permanent Quarters and I enclose a list of the members as it now stands.

This committe is to select from its own members a special committee on Finance.

In order to organize for the season's work you are respectfully requested to attend a meeting of the committe to be held at 127 E. 23d. St. on Tuesday Oct. 9th. at 7.30 P.M. sharp. Per order of the Chairman.

Yours truly,
Ralph W. Pope,
Secretary.

X-E 62-98
1888-10-04

COMMITTEE on FINANCE, BUILDING and PERMANENT QUARTERS.

George M. Phelps, Chairman.

George A. Hamilton	Franklin L. Pope
Capt. O. E. Michaelis	Dr. F. Benedict Herzog
T. C. Martin	Francis R. Upton
Dr. Schuyler S. Wheeler	Thomas A. Edison.

X-E-6285-9
1888-10-

Tell Upton to make any changes as required & Experimental Lamps & send here for test that only is way to prove it TAE

RECEIVED
OCT 30 1888
EDISON LAMP CO.

Mr. T. A. Edison, Newark, N.J.

Dear Sir:—

I had a short talk this morning with Mr. Upton about "arch forms". I suggested that the treated fibres be given a final pre=liminary, so to speak, then sent to Force ~~en~~ for retreatment and after putting on the arch forms run in the furnace directly. So

you approve of
this?

Yours very truly
John W. Lawson

FRANCIS R. UPTON COLLECTION

1889

THOMAS A. EDISON, PRESIDENT.

FRANCIS R. UPTON, GEN'L M'G'R AND TREAS.

X-E6285-9
1889-04-03

EDISON LAMP CO.,

Harrison, N. J., April 3rd, 1889

Edward H. Johnson, Esq., President,

Edison Electric Light Company,

16 & 18 Broad St., New York City.

Dear Sir:-

Regarding the question of reduction in the price of lamps, I am very decidedly of the opinion that the Edison Company should uphold the present price of Eighty-five (.85) cents for lamps.

My opinion is based upon my firm conviction that the Edison Company will, in the course of two years, be placed by the Courts in the position of having an absolute monopoly of incandescent lighting.

I think that the Directors of the Edison Electric Light Co. should consider whether the business policy of the Edison Company should be based upon a firm belief of the validity of the Edison patents, and all its policy conducted by this belief, or if they do not firmly believe that the patents are perfect and not assailable, then the Edison Company must meet competition from infringing companies by reducing the price of lamps.

I believe that the Edison Company will command its trade by holding firmly to its price, and by announcing as its business policy, that it intends to hold aloof from any combination or con-

X-E62859

E. H. Johnson, Esq., # 2.

solidation with infringing companies, that it intends to enforce its patents, and that it does not consider that it can in any way meet the price of infringers.

The Edison lamp should be sold as a lamp protected by patents, and parties buying other lamps should be made to feel that they are buying at a lower price for the reason that they are buying an unpatented and infringing article.

The fact that the opposition offer lamps at a much lower price than the Edison lamp, if the Edison Company assert their claim in proper manner, will be a very strong argument for the validity of the Edison patents.

I do not believe that even in face of great losses that are now being made by customers buying lamps from other companies, that the Edison Company should run and break prices, but that it should stand firm and by its conduct in holding to its prices, asserting that it has full faith in its patents, and that it cares not whether sales are made by other companies or by itself, that it will insist upon its rights and expect to recover any present loss in future damages.

If the Edison Company do not consider their patents as thoroughly strong and absolutely to be relied upon, there is but one course open, that is, to meet competition by selling lamps at the price which they are offered at by other companies, and to endeavor to make up its losses by selling more lamps at smaller prices.

X-E 62-85-9

There is one condition of affairs that would warrant the Edison Company in breaking prices to a very low point. To-day the opposition to the Edison Company has become united into practically two companies with one of these companies controlling the trade. This company is known to be paying out very large sums under guarantees to other companies and to its own stockholders yearly. All information tends to show that the selling and manufacturing interests of this company are very much disorganized. Facts are stated showing that the selling department of this company is disorganized having now the men from three corporations to provide for, and the jealousy of three large corporations to satisfy. Information obtained from the factory of the Sawyer-Mann Company proves that at present the whole method of making lamps is under debate. There are now three distinct methods employed by this company, with three distinct forces of men, each force is endeavoring to prove that its own method is the best, and it is proposed to re-organize one of the factorys and to put in the new method of making lamps which will combine the best of all three.

This means a great deal of trouble and large expense for some time to come in the manufacture of lamps. This I know from sad experience in our own factory that any changes, no matter how trivial will result in having to make many other changes, and end in the disorganization of the whole factory, and a very large

X-E62-85-9

E. H. Johnson, Esq., # 4.

increase of the cost of lamps.

The Edison-Swan Company in England went through this same experience in moving their factory from Newcastle to London. The lamps produced after their removal were very bad and the troubles met with were very great, requiring a year of time to get over them.

If the Edison Company mean to meet the Westinghouse Company in commercial opposition, no better time than the present can be found, for by taking away the trade of lamps from the Westinghouse Company the expense of making the lamps in their factories will be very much increased, while the Edison Company will reap the advantage of the sales.

It is for the Edison Company before reducing the price of lamps to consider whether, the reduction is made as a blow struck home for the purpose of controlling the trade and to accomplish the ulterior object of disabling the Edison Company's antagonist, or is merely meant as a feint which will have little effect upon the amount of Edison trade, and will simply decrease the Westinghouse Company's profits and not strike home.

I consider that if the Edison Company make any reduction in their price, it should be such a reduction as would carry the trade to the Edison Company from the Westinghouse Companies, and will destroy the Westinghouse Company's profits.

The Edison Company are in thoroughly strong financial position, having no preferences or dividends to pay out, unless they are earned, while the Westinghouse Company has fixed charges amounting to Seven Hundred Thousand Dollars a year and no income except such as is derived from its warfare upon the Edison Co.

If the Edison Company decide to cut, it should be part of a well matured and well considered plan, and if the cut is made, it should be made in connection with the developement of several other plans now laid to ward off competition of the Westinghouse Company.

I think that when the plans regarding the challenge to Westinghouse are matured, and when the machinery ordered by the New York state has been purchased, and when Mr. Edison is prepared to announce publicly that he can meet the Pittsburg Suit with a much improved lamp, and when the announcement and advertisements of the Edison Company's position regarding the expiration of the Edison Canadian Patents can be brought before the public, and when a strong attack can be brought upon Mr. Westinghouse's position regarding the Automatic Brake, and when an active and vigorous effort can be made to place plants in small towns at prices which will meet the Westinghouse Company, then, all this should be vigorously pushed together with the cut in the price of the lamp which will control the trade absolutely.

I believe if the information which is considered to be cor-

rect by the Edison Company is correct, that Mr. Westinghouse can be brought to an agreement at least that he will quote the same price upon incandescent lamps that the Edison Company do, and give no rebates or allowances.

This is the position that the fight should be made for, for then the Edison Company can take their chances of controlling the trade due to the quality of the lamp offered, and the probability of the Edison Company winning their patents.

I think that before any cut is made in the lamp, that the Westinghouse Company should be notified that the Edison Company request them to agree to charge the same price for lamps that the Edison Company do; otherwise, the Edison Company is prepared to meet any competition regarding lamps that the Westinghouse Company may bring to bear upon them.

Yours very truly,

X-E6285-10

No. 978 Newark, N. J. June 26 1889

760 BROAD ST.

THE GERMAN NATIONAL BANK,

OF THE CITY OF NEWARK.

Pay to the order of Thomas A. Edison

Fourteen Thousand five hundred eighty three 34/100 Dollars.

$14583 34/100

Francis R. Upton

Pay T. W. CROOKS, Esq. Cash'r, or Order for Coll. Ac't of
NAT'L CITY BANK, N. Y.
G. S. WHITSON, Asst. Cashier.

Pay to order of
Henry Villard
Thos A Edison
By Saml Insull
Attorney

Endorsement guaranteed

HENRY VILLARD
By C A Spofford
Attorney

FOR DEPOSIT IN
NATIONAL CITY BANK,
NEW YORK.
TO THE CREDIT OF THE
FARMERS LOAN AND TRUST CO.
WM. H. LEUPP, Sec'y.

8165-W

THOMAS A. EDISON, President.
CHAS. BATCHELOR, Vice-Prest.

SAMUEL INSULL, Treas. & Genl. Manager.

J. HUTCHINSON, Secretary.
JOHN KRUESI, Asst. Genl. Mangr.

X-E 62-84-9
1889-06-28

THE EDISON MACHINE WORKS,

No. 19 DEY STREET,

GENERAL OFFICE AND WORKS:
SCHENECTADY, N. Y.

CABLE ADDRESS:
"XYDSUN, NEW YORK."

PERSONAL

NEW YORK, June 28th, 1889.

My Dear Upton:-

I have the pleasure to enclose herewith accounts of Lamp Stock, Bergmann Stock and Light Company Stock, showing debits against me of

	$2,108.34
	2,720.00
	5,186.31
Total	$10,014.65

I return herewith your memoranda, also Drexel, Morgan & Co's check for $66.67 endorsed, which now only requires your own endorsement.

I have added to the amount of $10,014.65, $30.00 so that you will deliver me 107 shares of Preferred Stock, as the Company does not make Fractional Shares. You will note that you have worked out to deliver me 106.70. My check is therefore $10,044.65 which please acknowledge.

Unless I am very much mistaken, I owe you 1/2 of the 15 Deferred Shares and 1/2 of the 25 Preferred Shares, which you delivered at the time you left that check for $1900.00. One half of each of these parcels will be respectively, 7.50 and 12.50.

In order to make an even number of shares I have taken

8165-W

THOMAS A. EDISON, PRESIDENT.
CHAS. BATCHELOR, VICE-PREST.

SAMUEL INSULL, TREAS. & GENL. MANAGER.

J. HUTCHINSON, SECRETARY.
JOHN KRUESI, ASST. GENL. MANGR.

X-E62-85-9

THE EDISON MACHINE WORKS,

No. 19 DEY STREET,

GENERAL OFFICE AND WORKS:
SCHENECTADY, N. Y.

CABLE ADDRESS:
"XYDSUN, NEW YORK."

PERSONAL.

NEW YORK,

0.50 from the Deferred and added it to the 12.50 of the preferred, thus making an even number, 7 Shares Deferred, and 13 Preferred, so that the exact quantity of Deferred shares you will have to deliver me will be 57 and Preferred 94.

Very truly yours,

Saml Insull

To F. R. Upton, Esq.,

Edison Lamp Co.,

Harrison, N.J.

[ENCLOSURE]

X-E63-89-9

NEW YORK, June 28, 1889.

MR. SAMUEL INSULL

In account with

FRANCIS R. UPTON.

		Dr.		Cr.	
	LAMP DEAL.				
	To 1/4 of 10 Shares at, $4,500 ea.	11250			
	1/4 Interest on 10 Shares $3899.97	974	99		
	Sep. $1800				
	Dec. 1125				
	Mar.20th to June 7th 974 97				
	By Cash, 2 1/2 Shares, $3,416.66			8541	65
	Div. " " 450 per Sh.			1125	
	Cash pd. by S. Insull,			450	
	Balance			2108	34
		12224	99	12224	99

	Balance down	$2108.34
Light Deal	" "	$2720.00
Bergmann.	" "	$5186.31
	Total	$10014.65

E & O E
June 28 89
Saml Insull
By Thomas Butler.

[ENCLOSURE]

X-E6285-9

NEW YORK, June 23, 1889.

MR. SAMUEL INSULL,

In account with

FRANCIS R. UPTON.

		Dr.		Cr.	
	BERGMANN STOCK.				
To	1/2 of 50 Shares at 70	1,750	00		
	8 mos. Interest on do.	70	00		
	Check rec'd from F.R. Upton,	1,900	00		
By	Div. 25 Bergmann			50	00
	Cash, Drexell, 25 Shares, at $38,			950	00
	Balance,			2,720	00
		$3,~~720~~ 720	00	$3,720	00

Balance down $2,720 00

E. O. E.
June 28 / 89
Saml Insull
by Thomas Butler.

[ENCLOSURE]

X-E6285-9

NEW YORK, June 28, 1889.

MR. SAMUEL INSULL,

In account with

F. R. UPTON.

	Dr.		Cr.	
LIGHT COMPANY STOCK.				
To 10 Shares Light Stock,	1,337	50		
1/4 Share of 100 Shares, costing each, $200	5000			
1/4 Int. on loan $21,000 $378.50 433.40	202	97		
By 2 1/2 Shares of $66.67 Fractional Certificate			16	66
Note, 4 months			1,337	50
Balance			5,186	31
	$6540	47	6540	47

Balance down $5,18631

E. & O. E.
June 28/89
Saml Insull
Thomas Butler.

THOMAS A. EDISON, PRESIDENT.
CHAS. BATCHELOR, VICE-PREST.

SAMUEL INSULL, TREAS. & GENL. MANAGER.

J. HUTCHINSON, SECRETARY.
JOHN KRUESI, ASST. GENL. MANGR.

X-E 62-85-9
1889-07-02

THE EDISON MACHINE WORKS,

No. 19 DEY STREET,

GENERAL OFFICE AND WORKS:
SCHENECTADY, N. Y.

CABLE ADDRESS:
"XYDSUN, NEW YORK."

NEW YORK, July 2nd, 1889.

3

Dear Mr. Upton:-

I wish you would send me the contribution of $8750 in cash, preferred shares and deferred shares, which are to go to Mr. Villard on the lamp deal. You and Lucy E. Upton I believe, hold 5 shares. The total amount of the subscription in cash and shares will therefore be 1750 X 5-- 8750, divided as follows:

Cash	$2850
Preferred Shares	3700
Deferred Shares	2200
	$8750

These figures are not altogether exact, but they are approximately near enough. As the Company do not make fractional shares, we are compelled to arrange the fractions in the most equitable way possible, and this is the result.

Yours truly,

Saml Insull

by Thomas Butler.

8165-W

THOMAS A. EDISON, PRESIDENT.
CHAS. BATCHELOR, VICE-PREST.

SAMUEL INSULL, TREAS. & GENL. MANAGER.

J. HUTCHINSON, SECRETARY.
JOHN KRUESI, ASST. GENL. MANGR.

X - EL-8559
1889-07-02

THE EDISON MACHINE WORKS,

No. 19 DEY STREET,

GENERAL OFFICE AND WORKS:
SCHENECTADY, N. Y.

CABLE ADDRESS:
"XYDSUN, NEW YORK."

NEW YORK, July 2nd, 1889.

RECEIVED
JUL 3
EDISON LAMP CO.

Dear Mr. Upton:-

With further reference to my letter of to-day, with regard to the contribution of $1750 on Lamp Stock. There is still outstanding John W. Howle's stock. Please have this looked up -

Yours very truly,

Saml. Insull
G Thomas Butler
General Manager.

F. R. Upton, Esq.,

Edison Lamp Co. Newark, N.J.

X-E6298
1889-09-05

RECEIVED
SEP
5
1889
EDISON LAMP CO.

EDISON GENERAL ELECTRIC COMPANY.

Mills Building,

N e w Y o r k, September 5, 1889.

Francis R. Upton, Esq.,

Harrison, N.J.

Dear Sir:

I beg to inform you that, at a meeting of the Executive Committee of the Board of Trustees of this Company held on the 29th ult., you were appointed a member of the Technical Committee.

I am, dear Sir,

Yours very truly,

[signature]

Secretary.

THOMAS A. EDISON, PRESIDENT.

X-E 6298

FRANCIS R. UPTON, GEN'L M'G'R AND TREAS.

EDISON LAMP CO.,

HARRISON, N. J., November 26th, 1889

Samuel Insull, Esq., First Vice Pres.,

United Edison Mfg. Co.,

44 Wall St., New York.

RECEIVED
NOV 27 1889
Ans'd 188

Dear Sir:-

We notice a growing tendency on the part of all the Local companies to put complaints for lamp breakage through the office of the General Edison Co., so as to bring more pressure to bear upon us. We think, that if this policy is adhered to it will enormously increase the correspondence of the General Company, and be a very great detriment to the business. We feel ourselves fully able to take care of all complaints from Central Stations regarding lamps, and to keep the Central Stations friendly to this company and to deal with them equitably, but we know that in case Central Stations feel that they can bring pressure to bear upon this company by writing to the General Company office, it will result in their not being willing to receive any settlement we would offer to make, and a tendency to continually ask for more adjustments than they are entitled to.

We think that all correspondence regarding such matters should be referred to us, and that we should be held responsible until complaints are at least a year old, for it takes about a year to smooth over and thoroughly adjust a serious complaint.

X-E 6298

Samuel Insull, Esq., First Vice Pres. #2.

We invariably endeavor to keep the matter of a complaint quiet for a period, and then when the pressure has been arranged, and the life is satisfactory, or a far better average life than that guaranteed has been given them from the lamps received, and the parties are in a reasonable temper, we then make some adjustment and rebate, and by some attention to the local authorities in the way of small lamps or a present of some kind, gain the good will, and continue in friendly lines.

If, however, your company are going to take a stand to force us to make prompt settlements or adjustments with them, you will find that every company in the United States will think that letter writing pays and that they can get good pay for a clerk to complain of every lamp that burns under fifty hours in their station.

We can quote Wilkes-Barre as one instance, they have been endeavoring to get from us 500 lamps, and we were able to show them that their average life was over 1000 hours. The man who was pushing this complaint, has since resigned his position, so that the complaint will fall, and we shall be able to adjust any little troubles with the new manager, and still be on friendly relations. Whereas, if the company was in correspondence with the General Company regarding the complaint, they would feel that this correspondence must be kept up and pressure continually brought on us so as to force us to give them lamps.

Yours truly, Francis R. Upton

FRANCIS R. UPTON COLLECTION

1890

X-E-6285-8 (1890)-02-06 from envelope

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, ______ Orange, N.J. Feby 6

Upton = I think you better take Hipple over to Lamp factory permanently I have no work for him now since pumps & glass machines are finished —

Have told Balch to tell Brown that he is to go to your House for money or any filiments he wants or wants to deliver do this temporarily then I will arrange it to be done at Laboratory

Edison

LABORATORY
OF
THOMAS A. EDISON,
ORANGE, N. J.

X-E6285-8

ORANGE FEB 10 11 AM 18

Francis R Upton Esq
Edison Lamp Works
East Newark
N Jersey

[FROM WILLIAM H. MEADOWCROFT]

X-E6285-9
1890-03-21

Mr. Upton:

The argument is certainly a very strong one, and the course proposed seems to me to be the only practical one the Edison Co. can adopt to head off some of the large amount of business now captured by the alternating

X-E6285-9

people. The line of argument proposed is one that lets the Edison Co. out of its position on alternating system and puts the burden on the customer if he _will_ take the alternating after its disadvantages and dangers have been pointed out.

WHM.

Mch 21/90

[ATTACHMENT]

X-E6285-9

One the necessity of our having an alternating system immediately,

There is only one way to compete with the alternating system in cases of central stations in small towns, and that is with an alternating system. Until we can offer both the three-wire and alternating systems, all arguments against the alternating are of no weight.

The purchaser considers that we condemn it merely because we do not have it to sell, and, of course, the agents of the competing companies foster this belief. There are no controlling patents on the alternating system. We have the exclusive right for America, under reasonable terms, to use the best one in the world.

The three-wire patent is acknowledged good by competing companies who state that, while the patent is good, they have no desire to use it, as it is inferior to the alternating and far more expensive. We can readily place ourselves in a position to offer either or both. The competing companies will not offer the three wire system and indemnify the purchaser, as I know from the fact that, when I was not with the Edison Company, I endeavored to get them to do so. It is evident that, by having an alternating system, we can offer all the opposition does and the three-wire in addition, and by offerring the alternating and advising the three-wire, we can sell the three-wire at a figure which at present does

[ATTACHMENT]

X-E62859

not enable us to even secure consideration.

In six recent cases of small central station plants in Illinois, the alternating system secured every one, although we were represented by an experienced and and first class agent. In four cases ouf of the six they would not consider a bid on the three-wire system. In the other two we bid but stood no chance whatever of getting the contract. Our agent who had been promised an alternating system for eight months, had not been able to make any sales of three-wire systems and, after this last experience, resigned and accepted a position with the Westinghouse system, although he will be limited to the one County in which Chicago is situated and where the Edison interests are supposed to be more strongly entrenched than anywhere in the country. The agent was a warm personal friend of mine and only left us when absolutely convinced that he could not meet the competition with the three-wire system.

With the three-wire system it is necessary to establish the entire system of distribution at the outstart. You cannot put up conductors for a small percentage of the anticipated load and extend later. This means that the purchaser must spend several thousand dollars for copper and pole line when he does not feel sure of the result. With the alternating the purchaser can start with extremely light conductors on light poles, supply a few scattered lamps, regardless of distance and only invest a few hundred dollars at most in the beg nning. Later, as he secures consumers,

[ATTACHMENT]

X-E6285-9

he can buy converters as he needs them and place them in service at any desired place.

It is almost invariably the case in small towns, that there is a small business centre and the wealthiest people live upon the out-skirts of the town. The people you desire to interest always want the light in their residences. With the alternating this is no trouble. With the three-wire the cost is excessive, if not prohibitory. With the alternating the purchaser invests a few hundred dollars to supply a small initial load scattered perhaps over about two miles square. With the three-wire he must invest several thousands in order to establish thesystem necessary for the future requirements and even then cannot reach the distant residences.

Two years after starting, when the full load is secured, the alternating will have cost as much as the three wire under ordinary circumstances, but it requires more than ordinary faith on the part of the purchaser to invest thousands of dollars in a speculative enterprise when he can avoid it and only invest as he closes contracts ensuring a certain return for the investment.

The efficiency of the alternating system is undoubtedly 20% less than the three-wire, but our agent&s statement is controverted by that of the opposition agent, who claims just the reverse, and until we have an alternating system, our agent will not be believed in preference to the alternating agent. With both systems to offer, our agent will be in a position of apparent indifference as to which is used so long as we secure the sale and his statement as

[ATTACHMENT]

to danger, lack of efficiency, &c., will carry weight.

Even if it is granted that the alternating is 20% less efficient, what does this mean? Merely that 20% morepower is required, that is, the coal bill is increased by 20%. In the average sized central station plant for small town, namely, 600 lights, the coal bill averages about $60. per month. An increase of 20% means $12. per month. This is not sufficient inducement to warrant investing several thousands more in the beginning. The danger element is left but this is insignificant in small scattered towns with few wires and even when fully appreciated does not prevent the average purchaser from investing his money in a paying enterprise.

In large cities all is reversed. The density of the lighting justifies a station for a comparatively small area. The necessity of underground service gives us tremendous advantages due to the difficulty in insulating high pressures underground.

The multitude of wires makes the danger risk very serious and the revenue from sale of power enables us to sell light at a profit below the cost of production by an alternating system. In small towns there is no revenue from the sale of power. The advantages are all with the alternating at the time of making the sale.

Our Company should be able to supply any kind of electric service desired by the purchaser. We must sell the purchaser what he wants or lose the sale. At present he wants the alternating for small towns, consequently we lose the sale. When we can

[ATTACHMENT]

X-E6285-9

supply him anything he wants he will want that which we recommend as the best, namely, the three wire system, notwithstanding the greater cost.

I earnestly recommend the immediate introduction of the Zipernowsky-Deri alternating system, for which we hold the exclusive rights and that negotiations be entered into at once with Messrs. Ganz & Company, the owners abroad, to accomplish this under the best terms possible.

X-E 62-98

7 East 72nd St.
New York, March 22, 1890.

Mr. Henry Villard requests the pleasure of your company at dinner on Monday, March 24th, at 7 P.M., to meet Managing Director Rathenau of the German Electricity Co. of Berlin.

R.S.V.P.

X-E6298
1890-12-22

Società Generale Italiana di Elettricità
Sistema Edison

MEDAGLIA D'ORO DI 1a CLASSE
del Ministero d'Industria e Commercio

DIPLOMA DI MERITO DI 1° GRADO
Espos. Internazionale di Milano 1887

DIPLOMI D'ONORE
Espos. di Parigi 1881 _ Espos. di Torino 1884
Medaglia d'Oro all'Espos. delle Provincie dell'Emilia nel 1888

Società Anonima
Capitale L. 6,000,000, interamente versato.

Rappresentanza del Sistema ZIPERNOWSKY-DÉRI

Indirizzare le lettere alla SOCIETÀ _ Per telegrammi: EDISON. MILANO.

Milano, Dec 22nd 1890.
Via A. Manzoni, 12.

Francis R. Upton Esq
Edison Gen'l Electric Co.
East Newark N.J.

Dear Mr. Upton:
I read in the last number of the London "Electrical Review," an article by Mess. Kennelly & White on the New Standard Edison Meter being an extract of the Paper read before the Convention of the Association of Edison Illuminating Companies. I would esteem it a great favor if you could send me a copy of the minutes of these meetings as they contain much that is of interest to me. Of the meetings of 1887 and previous years I have copies and if possible I should like to have the reports

of the meetings held in 1888-1889-1890."
As an "Edison man" away from Headquarters such a distance these reports are very interesting and valuable to me and I would esteem it a great favor if you will kindly procure them for me. I had a long correspondence with Mr. Jenks on the subject of the modifications to be made in the Meter and I am desirous of seeing the result of the work. We have now about 1750 Edison Meters (2 wire & 3 wire) in use and some 50 Aron Meters. These latter are giving excellent satisfaction and although we charge a yearly rental of five times the charge for the Edison Meter we have no difficulty in their introduction with the advantages to the consumer that a direct reading meter ensures. For installations below a capacity of 10 Amperes especially for private dwellings the yearly rent of the Aron meter becomes prohibitive. Our catalogue price for Lamps

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Società Generale Italiana di Elettricità
Sistema Edison

MEDAGLIA D'ORO DI 1a CLASSE
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Capitale L. 6,000,000, interamente versato.

Rappresentanza del Sistema
ZIPERNOWSKY-DÉRI

Milano, 189

Via A. Manzoni, 12.

Indirizzare le lettere alla SOCIETÀ _ Per telegrammi: EDISON. MILANO.

has been reduced to 2.50 fr (50 cts) and to large customers we go down as low as 2.20 fr (44 cts)! What with the heavy redevance to the Paris Company it is a very tight squeeze.

The Paris Company made an offer which we hold, a copy to one of our customers in Italy & it is more than likely that this irregularity will form the basis of a refusal on our part to continue to pay the royalty. this would put American Lamps on an equal footing with French Lamps.

As already communicated to Mr. Dyer our Company is manufacturing lamps on the Edison-Swan lines. although the product is not as good or as regular as might be the case. The Lamps cost us

about the same as your Lamps but I must admit the quality is somewhat inferior although improvements are forthcoming. Our Station is now running a Capacity of 20,000 Lamps (Incandescent) & 500 Arcs of the low tension circuits and we have a separate Station (T-H System) with a capacity of 500 Arcs. I expect to return to America on the termination of my contract with this Company (end of 1891) and I will communicate with you some time before I leave Milan.
My plan was to leave sooner but our people here desire to have me stay & I have decided to comply with their wish and remain the full contract term. Allow me to take the opportunity of extending the Compliments of the Season and thank you in advance for what you may do towards procuring the reports.
I am Dear Sir
Yours very truly
[signature]

X-E628N-9

-: INSTRUCTIONS TO FOREMEN:-

(1890)
see p. 3

(1) You are to take orders regarding everything concerning your work from the Supt. of Manufacture, or in his absence from the Asst. Supt. and from no one else, except as is outlined in these instructions.

(2) You will send a request to the Supt. of Manufacture asking for any help that you may need or suggesting any change in rate of wages, and in case you do not get help promptly, you should ask again. Wages can only be changed by the Supt. of Manufacture, you have no power to alter any wages, but are expected to call his attention to any inequalities that may occur. You are given the right to discharge any one in your room on the spot. In case you exercise this right, you should report the same and the reasons for discharging any one, immediately to the Supt. of Manufacture.

(3) You are expected to remain in the room immediately under your charge at all times during business hours, whether the factory is running or shut down, except business immediately connected with your duties require your presence in other rooms, where you should not remain beyond the time needed for the business on hand.

If there is nothing to do in your room, report to the Supt. of Manufacture at his desk, for permission to go home. While you are on duty you should be at your post.

(4) You are to make a request, in the book furnished for this purpose, on the Supt. of Manufacture for any work or any material which does not enter into the lamp itself, which is required in

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your room. This should be done, not only for repairs but for any new tools or alteration to be made in your room. Putting one job only on any request. In case you notice any work being done, which you have not made a request for, you should promptly notify the Supt. of Manufacture of this so that it may be investigated. In case of break-down or sudden emergency you should send word at once to the Supt. of Equipment and make out request as soon as possible thereafter.

(5) You are expected to make factory hours, as placed upon the regulations for the factory, except in case of shut-down, so that you have nobody working for you, when you are expected to make the hours from 8 in the morning until 5 at night, unless you receive explicit permission from the Supt. of Manufacture, or in his absence, the Asst. Supt. of Manufacture, to remain away from the factory.

(6) You are expected to get a receipt for all goods delivered from your department, and to give a receipt for all goods that you receive into your department. You will deliver your breakage to the elevator for the breakage room, sending a receipt for the same to the breakage room. The receipt should be pinned on a box by a thumb tack in your room. If receipt is not promptly returned send a note to the desk of the Supt. of Manufacture.

(7) You will accept the Asst. Supt. of Manufacture's orders for the style of material and for the style of lamps to be run. You will run only upon the Asst. Supt. of Manufacture's orders, and

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in case you have any material on hand which you do not understand about or special orders which you do not fully understand, you will report the same to the Asst. Supt. Of Manufacture, asking regarding it. The Asst. Supt. has been given entire charge of orders and of the following material through the factory. And of the inspection of material used. Foremen are to aid him and the purchasing Clerk in every way to inspect material promptly and thoroughly.

No deviation should be made from existing models and the style of lamps except by written instructions from the Asst. Supt. of Manufacture.

Each foreman should promptly notify the Asst. Supt. of Manufacture, in writing, using book provided for the purpose, of any defect or lack of supplies which, in his opinion, would interfere with the prompt and proper carrying out of the work in his department, so that the Asst. Supt. of Manufacture may be fully informed as to the working capacity of the factory.

(8) Instructions dated June 12, 1890, are to be considered as in force; Mr. Hansen being placed in charge of records under the Asst. Supt. of Manufacture, as follows:

"John A. Hansen has this day been appointed Clerk of Work in Progress. Foremen must give him all information requested by him as to the number of lamps or parts of lamps, received, delivered, and in stock.

Reports are to be given to him before 8 A.M. for previous day's receipts and deliveries.

Foremen are to detail help at any time requested by Mr. Hansen to count stock in their room. Foremen are not to keep any records of lamps received, delivered, or on hand, beyond the slips sent to Mr. Hansen, of receipts and deliveries, and of account of stock, when requested by him, except so far as is necessary for the making up of Pay Roll."

(9) You are to deliver to the Supt. of Equipment anything in your charge which he may request, either verbally or in writing, and take a receipt from him or his representative for the same. This receipt should suffifiently describe the goods, so that statement of cost can be made up from it. You are to furnish the Supt. of Equipment with all information he may desire regarding the working of your room. In case the Supt. of Equipment requests you to do some work for him, you will do it, and place upon the receipt, the time of the man who did the work and when you delivered the work, finished, you will get a receipt for the same. These receipts are to be sent to the Clerk of Work in Progress with the other receipts.

(10) For any supplies which you may need that enter into the lamp itself, you will communicate with the Asst. Supt. of Manufacture, using book furnished for this purpose, and he should, upon your request, see that you have the goods; if you do not get what you want promptly, make another request of him.

(11) The following rules are to be enforced by you in your room over all help and in the yard over any help under you.

X-E 62859

Rules 8 and 10 are to be enforced by you strictly. You will not allow any one to visit your room at any time except on business.

During the noon hour no one should visit your room except with written permission from the General Manager, Assistant Manager, Supt. of Manufacture or Supt. of Equipment.

RULES.

EDISON GENERAL ELECTRIC COMPANY, LAMP WORKS,

Harrison, N. J.

(1) HOURS OF WORK: 7 A.M. to 12 M., and 12:45 P.M. to 6.30 P.M.
Saturdays, 7 A.M. to 12:15 P.M.

(2) Employees are required to be at their places for work during these hours.

(3) Permits to leave the factory must be obtained from the Foreman of the room.

(4) Employees are required to notify their Foreman of any intended absence.

(5) Remains of lunch and all other refuse must be thrown in the waste can. Violation of this rule carries the penalty of immediate discharge.

(6) All employees who are late will be admitted through the gate house at 7:50 A. M.

(7) Throwing missiles or snow-balls in or around the yard, loafing around the room, loud talking, whistling or annoying passers-by in any manner is forbidden under panalty of immediate discharge.

(8) All employees are forbidden to visit other departments than their own unless sent there by their Foreman.

(9) Employees are to give one week's notice before leaving or discontinuing work.

X-E 628-9.

(10) It is expected that all employees will conduct themselves in an orderly and respectful manner on or around these premises.

(11) All employees must be at their places when the whistle blows, and remain there, whether working or waiting for orders, until whistle blows for closing the factory.

(12) All clothing, shoes, and personal belongings must be removed on the last Saturday of each month, or they will be thrown among the waste of the factory.

Francis R. Upton,
General Manager.

(12) Foremen will keep account of the time of all those in their room on forms prepared for the purpose.

They will also keep account of all piece work and give the Head Accountant or his representative any information or assistance they may request to enable them to make out the expense of the room.

Superintendent.

X-E62859
(1890)

METHODS OF ORDERING GOODS NOT ENTERING INTO THE LAMP OR
HAVING REPAIRS DONE IN THE FACTORY.

Each foreman should have a book which will allow of a carbon copy being made and will bear the address of the Supt. of Manufacture. These books should be used to make out requests to the Supt. of Manufacture for all work to be done in the room in charge of any foreman. The intention of this is that the foreman shall know what work is to be done by any workman who may come into his room to make repairs or alterations, and also that each foreman may have brought to his attention any repairs or alterations that is proposed to be made. In case of break-down or great necessity word should be sent immediately to the Supt. of Equipment, before the request is made out, to have the same repaired, and as soon as possible thereafter, request should be sent to the Supt. of Manufacture, so that proper records can be kept of the fact. The Supt of Manufacture will be furnished with two stamps, one stating that the order is for addition to plant, which increases investment, the other stating that the order is for repairs, or for materials which will be destroyed and enter into the cost of the lamps. The Supt, of Manufacture will stamp all these requests with either of these two stamps.

It is expected that this method of carrying out orders should be used, as far as is practical, so that as many orders as possible will originate from some one of the many rooms of the Factory.

When the request reaches the office, it will be treated

as belonging to one of the four classes of requests.

First Class;

The first method of treatment is for all orders to be filled from the office. This will cover all orders for printing, pencils, pads, writing materials, blank books and factory forms.

When a request is for any of the above, it will be stamped by a rubber stamp in the office which will state "to be ordered from office," and this stamp will be initialled by the General Manager, Assistant Manager or Head Accountant, and the order will be made out in the office on the regular forms for orders.

Second Class;

When the request reaches the office, if there is a stock of material in the office on hand from which it can be filled, the request will be stamped in the office "to be taken from stock" which stamp will be signed by either the General Manager, Assistant Manager or Head Accountant. Both these requests, as above, after they have been stamped and filled, will have entered on the back of them, the cost of the materials to fill the request, and then the request should be placed upon the files, in such a way, that the Head Accountant can consult it to make any statement of the department which it is for, that he may wish.

Third Class;

If the request comes to the office marked by the Supt. of Manufacture, "for repairs" which does not come under either of the previous classes 1 and 2, an Equipment order directed to the Supt. of Equipment will be made out. This is known as # 1 Form, and is to be used for repairs, etc., and for articles to be sold which

would be manufactured by the Supt., of Equipment.

Fourth Class;

For requests which bear the stamp "for new installation that adds to investment" #2 Form should be used.

#1 Form will be signed by either the General Manager, Assistant Manager or Head Accountant. #2 Form, unless it is of great necessity, will be signed only by the General Manager, except when he is absent and cannot be reached. Two copies of both these forms will be sent to the Supt. of Equipment.

When #2 Form is used it shall not go into effect until an estimated cost has been placed upon the Form. The Supt. of Equipment will keep the cost on the back of these forms for the information of the Head Accountant.

Any work which cannot properly be charged to any one of the Departments, requests for the same may be sent to the order desk by the General Manager, Assistant Manager, Head Accountant, Supt. of Equipment or Technical Adviser. These requests should be made out upon a blank pad or verbally. The Purchasing Clerk will make out a memorandum order, if it is for material coming under the first two classes mentioned in this. This memorandum order will be the same size as the request order used in factory. If it is not for these materials, he will make out an Equipment order for the amount, the same as if he were to cover requests from the Supt. of Manufacture in regular routine.

These Memorandum orders and Equipment orders should be initialled by the party who makes the request, and then should be

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signed by either the General Manager, Assistant Managor or Head Accountant.

The Supt. of Equipment may obtain any material that he may require in the factory, giving a receipt for it, which receipt should be sent to the Supt. of Manufacture, and from him to the Head Accountant, so that he may deduct the cost of it from the material used in the Department.

In case orders are for small amounts of unquestioned need the Equipment order should be signed by the Head Accountant.

When in doubt make out Equipment orders on Supt. of Equipment.

Equipment orders are intended to cover material which does not enter into the lamp itself. By material which enters into the lamp itself is meant, material which in its nature is such that when twice as many lamps are made twice as much material will be used and either destroyed or shipped with the lamp.

The intention of this is that the Head Accountant shall be informed of the cost of material used in making lamps as well as of material which is of the nature of General Expense or power expense etc., the cost of which will be shown by means of Equipment orders.

All transactions in the factory for material entering into the lamp itself shall be entirely in charge of the Supt. of the Factory, who will furnish the office with such Memorandums as are needful to find out the cost of the material used or work done.

N. G. X-E6285-9 (1890)?

Revised copy in Mr. Upton's file

OPINION REGARDING THE PROPER POLICY TO BE PURSUED IN
CARRYING ON THE BUSINESS OF LIGHTING BY THE
E D I S O N S Y S T E M.

To-day twenty million Incandescent lamps can be placed in the United States under such conditions that large returns can be earned on the money invested in erecting proper machinery for supplying the current to these lamps from Central Stations.

It is the rough estimate of those well acquainted with the business that one well paying lamp can be placed in a town, for every inhabitant of the town.

To protect this business of erecting Central Stations, and the full measure of profit to be derived from this business, is the fundamental principle on which all the Edison business should be founded.

The business of the Edison Company may be considered under two headings:-

That portion of the business which should be aggressive in its methods and pushed with the full strength of the Company, and that portion of its business which is defensive, and should be used to protect the weak points in the line of attack.

The attack should be made by the Edison Company erecting Central Stations as quickly as possible in the best paying territory in the United States, to do this intelligently, there should be in the possession of the Edison Company accurate information bearing upon the possibility of doing lighting in every town of

X-E6285-9

over ten thousand inhabitants in the United States.

A great deal of this information has already been obtained, an and should be carefully gone over and brought into such shape that it can be quickly appreciated.

The general headings of such information should be roughly as follows:-

Population of town.

Nature of business center.

Full statement as to the class of lighting and the average hours per day that might be expected from various kinds of lighting in the place.

Full description of present methods of lighting town, prices obtained and strength of Companies.

Map of town.

Location of as many lamps as equals one quarter of the inhabitants of the town, and also of station for this number, if the town is compact.

Full description of the government of the town, and the general nature of the methods used for getting franchises in the place.

List of the most prominent active business men in the town, with some personal description of the men. This list should cover those men who are to a large extent influential in political circles as well as business circles, and whose influence would have much to do with obtaining franchises.

X-E 62-85-9

It is suggested that there should be a bureau of the Edison Electric Light Co., whose special business should be to obtain franchises, and to this bureau if such were established, this obtaining of information should be alloted.

As rapidly as the information obtained showed towns which were thoroughly ripe for the electric light and in which an investment could be made with an absolute certainty of large returns, the Edison Company should immediately install a station, after having obtained a proper franchise, and interested some of the best local people in the enterprise, which latter could easily be done.

The Edison Company can give to local people, if necessary, a fixed amount of stock for the local franchise, it could also give some option upon blocks of stock to men it desires to interest

The whole policy of the Edison business in the past has been entirely wrong. When it is intended to put up a station in a town, the public should not be asked and urged to come into the Co. at the inception, when everything is doubtful, and success is a matter of representation upon the part of the Edison Company, but should be permitted and allowed to come in as a favor, and then only to a limited amount.

The Edison Company should install the plant from New York, and show that they consider it a good investment by being willing to put in money. The moment this is done the business of the Edison Company can be enormously increased.

X-E62855-9

Very profitable contracts can be made with Companies thus organized by the Edison Company, both as regards obtaining large share of stock as representing the patents, and also obtaining contracts which would be very profitable for the purchase of future material.

If the stock of such Companies is properly brought before the local public, there is no doubt but that the Edison Company can obtain these contracts and a large percentage of the stock, with a very small expenditure of money.

I have many times heard from local parties and been unable to answer the question why, if the erection of a central station is such a good investment as the Edison Company claim, are not parties in New York willing to put money into it. When an agent who is endeavoring to raise money for a Central Station is mc by this question, there is but one answer to be made to it, which is, that the Company is willing and will put money into the enterp prise.

No commission agents should be allowed in the Central Station business, all representatives of the Edison Company for installing Central Stations should be salaried agents with absolutely no interest beyond serving the Edison Company, to the best of their ability. A few well paid men can find more openings for the placing of the Edison apparatus than the present Edison shopscan possibly make even were they to work day and night.

The Edison business has been murdered in the past by an

X-E6285-9

almost absolute unwillingness of any one in New York to accept opportunities, no matter how promising, that were brought before them by agents, and also by the fact that enormous concessions were made to Companies to occupy territory, simply to get a small amount of money invested in such territory.

The Thomson-Houston Company of Boston, have shown conclusively how the opposite policy can be made successful, with a far worse system to put on the market than the Edison Company have had.

Again and again money has been absolutely thrown away, so far as any earning power was concerned, by the erection of experimental stations in large towns to show local people, what was well known to those familiar with the Edison business, that light can be supplied at the end of wires, situated in a certain longitude and latitude in the United States.

Large reductions from regular rates in many places have been made, to induce parties to invest money in an enterprise, who knew nothing about electric light except from the outside or from what had been told them by interested parties. This policy should be absolutely changed if the Edison business is to be prosperous.

The Edison patents for controlling Central Stations lighting are very strong and through them a full monopoly can be obtained of Central Station lighting. This business should be considered by the Edison Company as its main business, and should be looked

to fot profits. The installing of Central Stations can be made enormously profitable by the acquireing of stock and by the selling of the material used in erecting such stations, and the constant renewal needed for the enlargement of same.

A degree of the ill feeling that has arisen between the Electric Light Company and those connected with the Edison Manufacturing Establishments, has been due to the fact that those in the manufacturing establishments realized that there were so great opportunities lying unused for the erection of well paying central stations. The Edison Electric Light Co. have been constantly complaining that those connected with the shops were making all the money, while Mr. Edison and his associates in the manufacturing establishments have felt again and again that the Edison Electric Light Company were not pushing the business in any degree as it should be pushed. The manufacturing establishments were straining every nerve to enlarge their business and using all the money which could be obtained to increase their facilities, and taking very great risks. While the Edison Company with far larger field and much more promising out look stood with money invested in Rail Road Bonds, and with all tendencies to draw in any outside expenses so that the business could be handled with less outlay of money.

X-E6285-9

For the defense:-

The erection of Central Stations in small towns should be encouraged in every way by the Edison Company. In rapidly growing towns should, if need be, put Central Stations in with its own money. There is a chance to sell plants to a great many such towns to-day, if the Edison Company will help the local parties by taking bonds, or in other ways. This business can be made very profitable but should be considered primarily for the purpose of occupying territory and extending the sale of electrical material.

The Isolated business should be pushed sharply, the price list quoted the public on large sizedmachines should be kept up, and competative prices should be made by special arrangements with the purchasers.

This business should be pushed for large sales rather than for large percentage of profits.

On the small sized machines, which do not enter into Central Station work, very low prices should be established, this will head off a great deal of competition and stop a great many men from being misled by the fact that there are so many makers of electrical machines in the field.

The small machines are often used as trial plants and very often lead to much larger orders, and should be considered as means of entering a wedge to break open a larger business.

In this connection it would be well to have a type of small sized machine devised which should be very cheap to make, and which

X-E6285-9

which could be of low efficiency, for example, 70 per cent upon 25 amperes to 80 upon 100 amperes.

As another weapon of defense the Arc. Lighting should be entered into by the Edison Company, My opinion is fully set forth in letter to the Edison Electric Light Co., which is as follows:-

"Frazar & Co. are obliged by the requirements of their business in China, to purchase an Arc Light Plant.

Previously thay have bought any Arz Light Apparatus they needed from the American Company, since the failure of this Co. they are much embarrassed as to the proper parties from whom to purchase. As agents of Mr. Edison for Japan and China, they do not care to deal with any Companies which are antagonistin to the Edison Electric Light Co., in this country.

After careful search I am unable to find any Arc Light Co. in this country which is not to-day in active opposition to the Edison Co.

I cannot therefore, recommend any Arc Light to Frazar & Co. without, at the same time, recommending them to deal with parties who are defendents in suits brought by the Edison Electric Light Co.

As I am compelled by the exigencies of their business to make a recommendation, I desire to do so, acting to a large degree under your advize.

Will you kindly inform me what you think is the best course for me to pursue in the matter.

No more vivid illustration of what has seemed to me a business mistake upon the part of the Edison Company can be given than this.

There is no question to-day, but that Arc lighting has come to stay, equally with incondescent lighting. Also, that in any Co., which enters the business of furnishing Electric Light must be ready to furnish both styles of electric lighting.

Although we may prove conclusively that it is wise for people to wear woolen clothes, still we should have to furnish cotton were we in the Dry Goods business.

Five years ago the stand was taken by the Edison Elec. Lt. Co. that Arc lighting was for the day only, to-day the demand for Arc lighting is larger than ever before, on the part of the public, and the yearly increase is as great as ever. It seems to me, absolutely essential thatthe Edison Co. should either have an Arc system of its own, or be in a position to recommend cordially the Arc system of some other Co. which will be on friendly relations with the Edison Co.

I think the whole question, not only in its narrower aspect, as regards Frazar & Co. but in the broader outlook, as regards the decided policy of your company is well worthy of consideration upon your part."

X-E62-8529

Regarding the Motor Business:-

The Edison Company should supply the Dynamos to generate the current for Motor Stations in which Motors of any Company with which the Edison Company a re in alliance with, are to be used.

It would be well to give to the Sprague Company the supplying of the smaller motors which should be manufactured by the Edison Company, The Edison Company should enter the market to supply motors over Forty Thousand watts capacity.

The use of large motors for transporting large amounts of power, especially from falls situated some miles from where poower is needed, will be a very large business in a few years and should be most carefully cultivated by the Edison Company.

Regarding Municipal Plants:-

This portion of the Edison Business should be pushed very actively after careful investigation as to the patents involved. If it is decided that the present apparatus or appliances can be made, and break loose from patents of other parties the work should be very active to meet the competition.

In addition to the Municipal System, the Edison Company should immediately work up a long distance system of multiple arc lighting. Mr. Edison holds the patents for the best system of long distance direct distribution, and I consider that the Edison Co. hold the best set of patents of alternating distribution.

The Municipal System and long distance System should be considered as subordinate to the Central Station direct distribution,

X-E6285-9

in which the bulk of the most profitable lighting business is to be found.

Regarding the Lamp Business:-

I consider that the Lamp Business is one which can be made the most profitable branch of the whole Edison Business, to do this the business should be consolidated so that all that concerns the lamps should be in one department. Then the business could be far more carefully watched and in every way better guarded to secure the best possible results.

As it is now it is very difficult to meet customers and satisfy any complaints or to head off any competition. The business should be so handled that concessions, if necessary, can be promptly and quickly made to the customers, and that they be brought in more direct contact with the manufacturers.

In the past it was necessary to consult with three parties before any steps could be taken, namely, The Edison Electric Light Co., Edison Mfg. Co., and Edison Lamp Co., Such being the case it has been almost impossible to properly push the Isolated business, by having lamps at near proper candle power. By so doing in some cases running the risk of having small claims for guarantee.

In one item in the Lamp business special attention should be brought to bear, this is to almsp under 40 volts, explaining this is letter to the Electric Light Co., as follows:-

X-E 62859

" We beg to call your attention that the Edison Patents are weakest on low volt lamps, in such lamp's the question of the filamenttary character of the carbon may be raised. We urged upon you in the past to consider it a proper arrangement that you should sacrifice for the general good of the business your large royalty upon this question of lamps for a merely nominal royalty.

Mr. Meadowcroft has informed us that the Sawyer-Mann people are making a full line of low volt battery lamps, and intend entering the market this fall to make sharp competi tion.

We have given special attention to the Municipal lamps at a and have employed Mr. Card to push the business, feeling that it very important to meet competition with the thicker short carbons of other companies.

We have placed the price of Municipal lamps at a very low figure, considering their cost, with the same idea in view.

We think the Edison Light Co. should keep these facts in mind constantly, and we wish that you would ask legal advise as to our position and see if we are correct."

I consider that to push the sale of small lamps as a matter from which very little direct profit can be obtained, and very large indirect profit.

For example:- On a train such as the Penn. Limited Express between Chicago and New York, I think that special efforts should be made to have Edison lamps used upon same, and not allow other Companies to point out opposition lamps as being used.

Also, where Special dinner tables illuminations is being made I think Edison lamps should be the ones in use, even though the Edison Company sell them at practically no profit.

The small lamps enter into a class of trade which appeals to a great many and which is watched with great interest.

I take great pride in feeling, for example:- that when a surgical operation is performed that it is an Edison lamp that is used. Also, in special lamps, such as are used for lighting the Harbor of New York, I feel that the Edison Co. should endeavor

X-E6285-9

to have such work, and I feel that all those connected in the Edison Co., should take great pride that Edison Lamps are used for such important work.

I do not think that Central Stations should be erected as a matter of sentiment, but in small matters which cost but little and are much commented on, sentiment and effect on the public should be considered.

The general policy of the Edison Co. should be to have local companies sell light at as low figures as will bring the local companies returns upon the capital invested. By doing this the mass of business will be immensely increased and the Edison Company owning all manufacturing concerns will reap very large profits.

The lower the price that the light is sold at, the more stable the business and the less liable to attack from any other form of artificial light.

With the new lamp and approved appliances for making electricity, electric light can now be produced at a lower first cost than gas under similar conditions. Any lighting can be taken from large Central Stations so as to pay on account of the general law of averages.

The price at which electric light should be sold should be the price to meet gas prices; by so doing all the lighting of a territory can be taken by the local electric lighting Company.

This policy should be strictly pursued by the General Edison Company in all stations which are controlled by it.

X-E 6285-9

Having fixed this as the policy each station will rapidly increase and the sale of material to local companies will be mush multiplied, om yield larger profits to the General Edison Company.

FRANCIS R. UPTON COLLECTION

1891

X-E6298
1891-01-06

Jan. 6th, 1891.

J. W. Lieb, Esq.,

Milano, Italy.

Dear Sir:-

I am in receipt of your favor of the 22nd ult. I note your remarks regarding the minutes of the Edison Illuminating Companies and desire to obtain copy of their proceedings. I requested Mr. Jenks to forward copies asked for to you. It might be a good plan for the Italian Co., to become a member of this Association and have the records sent through it. I think that their membership would be very much appreciated and would prove of help to them.

I note your remarks about your return and spoke to Mr. Insull regarding the same. He said that he wanted to get in communication with you, as he was looking forward to placing you as soon as you come to this country. I advise you to write to him and find out when he wants you.

I wish you would give my best regards to your family.

Yours very truly,

[TO ALICE STILWELL HOLZER?]

X-E6285-10

Upton =
Don't remember him
Woman seems to be
an intelligent one
Edison

73 Washington St.
, 1891-02-25
Harrison
N.J.
Feb. 25th 1891.

Dear Madam,

I trust you will excuse the liberty I am taking, in writing to you, but a gentleman who knows our circumstances advised me to do so. I have been up to your residence in Orange twice, the first time you were gone to Boston to take the boys to School, & the second time you were engaged so I could not

[1]

see you. I know I am a stranger to you, but I am writing to intercede for my husband Mr. Clifton, who I trust Mr. Edison will remember if you will kindly speak to him about this matter.
Twelve years ago we were in good circumstances, for Mr. C. was a good Mechanic (Painter & Paper-hanger) & used to do all the best work in Metuchen which place was our home, & when Mr. Edison moved from Newark to Menlo Park, Mr. Clifton did all the painting & graining at his house, but I am sorry to say he was taken sick with the Painter's Colic, & was sick for several months. When he had recovered, his Dr. M. C. Hunt advised him to quit his business for a year or two until he had fully recovered his strength. Having a family of six children to support, it soon took all the money we had saved up, & I had to part with valuables that I had brought from home. Being well acquainted with Mrs. Edison, I went & asked her to speak for Mr. Clifton so he could get something to do in the Labatory, she said "Certainly" she would, & got him work testing lamps & worked there for one year & four months for six dollars a week, with the promise of an increase in his wages. My son Willie who was then

12 years old went with his father
to mark down the [illegible], & he received
2 dollars a week. Mr. C. could have
had plenty of work at painting &c,
but he was promised more money
which he never received, because at
that time they were removing to
Harrison, & Mr. Holzer said it would
be all right when they got fairly
started. So on the 1st of June, Mr.
Holzer sent for Mr. C. & Willie to
Harrison, but did not give him any
more wages until August. Still I
thought it was for the best, so it
was necessity compelled me to sell
the greater part of our happy
home, & move to Harrison where

 X-E62-85-9

we have had nothing but sickness
& trouble the eight years we have
lived here. I am sorry to say, when
Mr. Holzer left the works one year
last September, the following month
Mr. Upton put some-one else in Mr.
Clifton's place for six dollars a
week, just half what Mr. C. was
getting. When Mr. C. asked him what
he was going to do with him, he
said he would not promise him
anything. So Mr. C. has not been
doing anything to speak of since
one year last October, for it completely
broke him up. After spending his
best days, & always being at his

post to do his duty, he has lost all energy, & says it is no use trying to do what is right. We have no relations in America to lend us a helping hand, so please forgive me for troubling you. When we came to America 23 years ago last November with plenty of means, we had many friends, but I don't know where to find one now, but I have one happy thought, I know I have always done my duty. But its very hard to be so unfortunate, it seems everything goes against me for until last May all the gentlemen in the Office used to come & take Lunch at 2 o'clock, but since Mr. Holzer left they have a Restaurant in the Factory. I don't think I charged too much (25 cents) Dear Madam, I trust you will excuse me for troubling you, but surely there must be something to do, if not at his trade he will be glad of anything to earn an honest living. I have one son Willie working in the Factory at Glass-Blowing, but he is a young man now & wants his wages for himself, & I have had to keep my daughter Lillie home to help me, for we have to do all the work ourselves which keeps us busy all the time. Another of

my boys is in Mc.Whister & Wilson's Dry goods store, he gets three dollars a week. – I am sorry to have written so much, & it would have been much easier if I could have been fortunate enough to have seen you. Will you please use your influence with Mr. Edison, to see if he could give some employment to my husband, & if you will kindly let me know the result. – Again apologizing for my intrusion,

Believe me, dear Madam,
Yours Truly,
(Mrs) Lillie Clifton. –

[8]

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Orange, N.J. March 4, 1891.

PHONOGRAPH DICTATION.

Francis R. Upton, Esq., Gen'l. Manager,

Lamp Mfg. Dep't., Edison Gen'l. Electric Co.,

Harrison, N. J.

Dear Sir:-

We find that carbons marked Jan'y. 29 - and put on test by us - and your corresponding order No. 2251 - are very good. Ascertain from Force and Hickman what difference there is in the carbons. I also want you to send descriptions of orders previously sent, so I can compare. We get your orders, but don't know how they are done; therefore cannot compare.

Yours truly,

Edison

[POSTMARK: AUGUST 11, 1891]

X-E6285-8 1891-08-11 (from envelope)

Upton =

The high temperature thins the dipping compound so they do not get but 75@80 percent of stuff on they do in cold weather - they either should add more asphalt or cool dipping tank - again they should run their preliminary 50 degrees higher in Summer and hold there 1/2 hour longer as their thermometer does not correctly give temperatures as they are arranged. - I told Martin some time

E-6285-8 (1891-08-11)

ago to make a tank of Syrian Asphalt, and to preliminarize his Carbons 50 degrees higher and hold there for hour longer than usual = ~~I~~ send some to Laboratory - I have received no word that they have done so. please have them do it = just as soon as I get released here I am going to Force & Hickman & stay there until the thing is ok - There is some damd little thing they have changed & cant see it = Edison

NEW JERSEY & PENNSYLVANIA CONCENTRATING WORKS, EDISON BUILDING, BROAD ST., NEW YORK.

Edison to Upton

E-6285-8

OGDENSBURGH N.J. AUG 11

ORANGE AUG 12 11 AM 1891 N.J

54/

Francis R Upton Esq

To Brevoort House 8th St & 5 Av ~~Orange~~ ~~N Jersey~~ New York

Personal

X-E6285-8
(1891-12-16)
(from envelope)

Upton

Come over and see me tonight
very important,

Edison

LABORATORY
OF
[TH]OMAS A. EDISON,
ORANGE, N. J.

X-E6285-8

WEST ORANGE
DEC
16
6 PM
1891
N. J.

Francis R Upton Esq

Orange

X-E6298
1891-12-18

#1, Dec. 18th, 1891

General Manager,

Second Vice President.

In accordance with your request of yesterday, I beg to submit to you a report covering the operations of the Lamp Works during the fiscal year ending Nov. 1st, 1891.

The past year has brought with it a complete change in the old methods of accounts, and in handling our business with the public. This has caused a number of expenditures, and some misunderstanding. I mention this as the re-organization has occupied a great deal of my attention, and has of necessity, prevented close attention being given to the details of the selling organization, as could be given in another year.

On the 1st, of November, 1890 a new price list went into effect which cut the prices of lamps as sold by us, and very largely cut the price of lamps as sold to the public. This brought immediatelt a very large amount of new business, much of which was of the nature that we were not acquainted with. Large orders were taken for low volt lamps with opposition plugs upon them, and these orders were taken without full knowledge of all the conditions that surround the trade on alternating stations. There was at the time, no reliable volt-meter to measure the voltage on alternating stations, and no conception on the part of anybody connected with the Edison Company that the variation of the volt-

ages was so great, and that the requirements of the lamps were so severe. This, together with the dislike of the public for a short filament lamp, entailed a very heavy expense upon this branch of the Works. We were obliged to take back 70,000 lamps, and give credit for them on account of their not giving satisfaction. We also destroyed a large number of these lamps that we had in stock, as they were of too high economy to be useful to the public. We had also to learn how to make all the opposition bases, and to change, in a number of instances, our styles so as to meet conditions which were unknown to us at the time that we took this trade.

We have profited by our experience to the extent that we now have a line of lamps with opposition plugs upon them which fully meets the requirements of the trade in the high volt class, and which are fairly salable in the low volt class. We are able to fill orders for this class of lamps with reasonable promptness, and to hold the sales that are made, and to give the satisfaction expected by the customer.

The Lamp Works for the above reasons have been at an expense which has gone into the cost of lamps, and against Sales of about $40,000 which we would not be at in another year with the present knowledge of the business.

The past year also brought to us a difficulty which we never had before, namely a difficulty of obtaining glass from the Glass Works. There was a strike declared last December at the

X-E6298

Corning Glass Works, which ran violently for about three months, and was declared off in about seven months. This put us to a large expense, so oftentimes we had to shut down or run slack for a lack of bulbs, and when we got them, we had to work overtime to push forward glass, and were compelled, in some cases, to make up lamps with the bulbs that we could get which were not salable at the time.

The result of the strike, though expensive at the time that it ran has been financially good for the Company. We are now able to buy glass of three or more makers at a price much lower than we have ever been able to buy it before. We are carrying a very heavy stock of glass in accordance with my wishes, so as to provide against the exigency of a second strike coming into the Glass Works. This year we shall probably have to carry a heavy stock of glass, and in future years, I will endeavor to so place our orders as to make the glass makers carry the stock, to a large degree.

In the manufacture of the lamps, great progress has been made in the methods of manufacture, and in economies which have been effected by improved methods. The new buildings which were erected for us have enabled us to handle our goods more economicall and with a better system.

During the past years the relations between the members of the staff of the Lamp Works have been revised, so as to improve the effifiency of each of its members, and now, I believe that the working staff is thoroughly enthusiastic, harmonious and progressive, and that the coming year will show further progress made in methods and in financial results

X-E62-98

The one thing that is needed at present is a better organization of the selling methods, so as to push out our goods more effectively.

In the past year, the models of the plugs of the lamps have been much improved in shape, and the method of putting the plugs upon the lamps have been improved. Our methods of gauging bulbs and of inspection and of buying bulbs has been very much improved, so that ourmproduct now will be better in appearance amd quality than ever before. The carbons that we use are now straighter and more symmetrical than at any previous time since we have adopted the new process, and in general quality, are of the best that have ever been made by these Works.

We have for several months in the later part of the fiscal year been getting out a new line of small lamps, candleabra lamps and special lamps, under the charge of Mr. Page, which we think will be ready to be actively pushed by the middle of January of next year. We anticipate that this line of lamps will produce large profits to the Company and will make our position in the trade much stronger than ever before.

The most important item in our business has been the improvement which Mr. Edison has made for us, under the contract with the Edison General Company, by which we estimate that a clear saving of $100,000 has been made during the past year, and from which a payment of $20,000 has been made to Mr. Edison.

 X-E 6298

A somewhat larger saving than this has been charged upon the books, part of which belongs to a period prior to Nov. 1st, 1890.

The saving in platinum wire of $61,000 has been the same as a saving in cash expenditures by this Company equal to the money which was saved. We had, for a number of years, been working to bring down the platinum to the smallest possible amount, and in my judgment under the old method, we had it down to as small a wire and as short a wire as could be used without changing the method.

The Edison Company has reason to congratulate itself on a saving of $80,000, which is equivalent to 8% upon all the money which is used in this branch of the business, as an investment, outside of good-will. The best part of this is that the saving runs on for years to come, and places these Works far in advance of any other manufacturer of incandescent lamps in cost.

So great is the saving that we can sell at our former cost, at a profit sufficient to earn interest upon the money needed to run the business.

In the years 1889 and 1890, the gross sales were $ 863,802.52,
on which the profits were ------------------------$ 277,963.82,
In the years 1890 and 1891, the gross sales were $ 980,505.73,
on which the profits were ------------------------$ 398,322.44.

In comparison of profits, the fact that the difference in price upon our sales is such that if the lamps in the years 1890 and 1891 had been sold at the price that was obtained in the years

X-E6298

1889 and 1890, we would receive ------------------$ 129,826.82 more.

As the Lamp Works made a much larger percentage of profit in the last year, I do not think that the Edison Company has any reason to feel that it cut the price unduly. It is impossible to trace the amount of sales due to the cut in price, and separate it from other sales, but, indoubtedly, a large number of sales were due, almost entirely to the price at which the lamps were sold.

The investment which was made for plant was, some of it, made before the beginning of the year, and did not become available until the first of January of this year. On account of the strike st the Glass Works, the increased investment, practically, did not become available until about the first of April of this year.

Since the middle of September of this year, we have been running somewhat slack so that we have not been availing ourselves of the investment, as we are now making more than half the number of lamps that we could make were we running full.

The present plant could produce 25,000-16 C.P. lamps in each working day, or its equivalent in value in lamps of other candle powers and styles.

The increase in plant in the last year has amounted to, see accompanying statement, $ 119,381.57 divided between Real Estate and Buildings ------------------------------$ 37, 151.36

Machinery and Tools -------------------------------$ 51, 753.11,

Furniture and Fixtures,----------------------------$ 26, 488.57

Canadian Plant,------------------------------------$ 3, 988.53

The present capacity of the factory being 25,000 lamps a day, an expenditure of about $200,000. would bring it up to a capacity of 50,000-16 C.P. lamps per day. This expenditure does not contemplate an enlargement to the Pump Room, but it contemplate the utilizing of the Pump-Room day and night for the purpose of exhausting lamps. It also does not provide for the increased stock which would have to be carried to provide for a trade of 50,000 lamps a day, effectually. There is one need in this business which I think should be provided whenever the Edison General Company feel that they can invest money for a contingency, that is the need of a fire-proof ware-house to store lamps. If this factory should burn down, it would be a great misfortune to many of the Illuminating Companies of the Edison General Co. For example, the Philadelphia Company carries an investment of about two weeks stock of lamps on hand, and the New York Ill. Co. often allows its stock to run down to less than a month's supply, and the Brooklyn Co. has been known to be without a week's supply of lamps. The Boston Co. orders its lamps twice each month and generally has less than a month's supply on hand. We have lamps stored in various buildings, and will store some lamps in the dwelling houses we have bought with the new property, so that we shall add this safe-gaurd to the business. As lamps so not depreciate at all in being held, and are not bulky in proportion to their value a store-house would not be a very expensive addition to our plant. The amount of lamps that can be stored in a ware-

house can be judged from the fact that a car would hold about 50,000 lamps, as packed by us.

The new power house, that is now going up, is so constructed as to allow easily of future increase in capacity. The additional capacity of the engines and dynamos that we will have in this house will be of the greatest value to us in the coming years, making the danger of break-down far less and increasing the capacity of our Pump-Room materially.

The new office in the main building has been of the utmost benefit to the health of those employed in the office with the sunlight in it, and being free from malarial trouble.

The increase of raw material, work in progress and finished stock during the past fiscal year has amounted to $277,546.80

This large increase has been due to a combination of circumstances. On Nov. 1, 1890, we entered that fiscal year with an exceedingly small stock of raw material due chiefly to the lack of any storage room in the factory at the time to carry a large stock. The work in progress was also very small as at that time we were pushing forward work, with very scant facilities, the new building not being available.

There was no stock between the departments as every room and every available space was occupied in manufacturing. This was not an economical or reliable method of manufacture, and we did it to force production. Our stock on hand was also very small for the reason that the orders were very much in excess of our

anticipations, and we thus drained down our stock below its normal. In contrast with the fiscal year 1889-90, when we had not room to carry bulbs, at the end of 1890-91 we had ample room, and had a very severe lesson in not carrying sufficient stock, by being brought close to having no raw material to manufacture with on account of strikes. In addition to this we had in process of manufacture a large amount between operation, and we were carrying a very heavy stock so as to provide against any cintingency of trouble with our glass-blowers. Of finished stock, we had over estimated the probable requirements of the season and were carrying in excess of what was needed for the immediate orders we were having. We were also carrying a very heavy stock to provide for special base lamps, and for special orders which we were not taking care of when the year opened.

We could make 25,000 lamps each day, and did we have the demand for shipping them, we could carry on our business with very little increase over the present stock of raw material, work in progress and finished stock that we now have.

Yours very truly,

X-E6285-8
(1891)

Upton =

Let me know how Pryce & ~~H~~ get along with the ~~temperature~~ Experiments in dipping also speak to Deshler have him send the daily life records of ~~Specials~~ only — dont want selected =

Edison

PS Things are rapidly getting in shape here monday we shall start for Experimental purposes =

E

Force & Hickman

X-E 62 85-8 (1891)

Please show Upton details of process, Company fear it might die —

Edison

Cable Address "Edison, New York."

X-E6285-8
(1891)

From the Laboratory
of
Thomas A. Edison,

Subject, ______ Orange, N.J. ______

Mart + H

The 10 sec dip are good carbons — The Ed Carbons Knocks out all others — the 6 X are next, but 6 X are badly covered with hairs & pressure spots while for some unknown reason Ed is free from either — You will have to experiment to reduce these hairs & spots as much as you can — You can easily lighten the pressure by notched End pieces and the hairs can be materialy decreased by brushing the Carbon sheets with the Camel hair brush which will break off any loose fibres You must put Cotton in Moulds or around the sheets & plenty of it as I have found unmistakeable oxidization = dont fail to do this — 4X had $\frac{1}{5}$ th the

Cable Address "Edison, New York."

E6285-8
(1891)

From the Laboratory
of
Thomas A. Edison.

Subject, ______ Orange, N.J. ______

Life of 5X due to pieces adhering - these pieces either increase electrical carrying or else bring the temperature of the filament down so the parts where there are no hairs or charcoal have to be raised very much higher to get the right candle power = & thats the difference between 6X & Ed =

These must be done =

1st Stop Oxidation
2nd Stop hairs & spots as far as possible
3rd 10 seconds or less dip =

Edison

X-E-6285-8
(1891)

Upton

Mart & Dave have sent me list of order nos which they mark 100 to 124 please write & tell me if you remember them & give the Correspdg numbers that I may identify them

Edison

The Carbon house Ex I do only have sent to factory E

X-E6285-8
(1891)

Cable Address "Edison, New York." From the Laboratory of Thomas A. Edison.

Subject: ______ Orange, N.J. ______

Upton =

I want 200 fibres not preliminaryed. 500 fibres ~~that~~ have been preliminaryed but not dipped

Edison

X-E 6285-8
(1891)

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, ______ Orange, N.J. ______

Hipple =

We have traced the Lamp trouble down
The average life of the Lamps you make now is
11 times less than our big Curve —
Two Curves set up of Lamps made the other day
show an average life to 10 oclock this morning
of (See List). while with the very same
Carbons put into Lamps and Exhausted here
~~The ... Curve~~ have gone See List
none broken —
two other Curves from carbons made following
days give (See List) none broken —
all set up at 420 Cphp — Your methods
in the pump room are defective —
You should run Lamps as we do here
The great injury to Carbons is from 0 up to
dull red if this is done quickly Lamps were

X-E 6285.8

"Cable Address "Edison, New York."

From the Laboratory
of
Thomas A. Edison.

Subject, Orange, N.J.

2

never any good - Large phosphorous Cup
plenty of fresh phosphorous. + surface
Exposed - Dont be sparing of phosphorous
I think you should have a phosphorous
inspector with orders to keep every pump
fresh only the slightest Evidence of glassy
surface should be allowed = Phos is
Cheap now and it should be used
freely = I am told you have very
small phosphorous Cups much smaller
than here This is a great mistake you
should use the same size as we do.

WE never heat Lamps here - Therefore
I dont think it necessary ~~that~~ you should
do so you could not make a poorer
Lamp than you do now even if you tried

X-E 6285-8

Cable Address "Edison, New York."

From the Laboratory
of
Thomas A. Edison.

Subject, Orange, N.J.

3

Joe will show you exactly how we run here and I advise that you gradually change over an Iole at a time = My impression is that the great cry for Lamps have caused you to quicken the Exhaustion biz to a point where Lamps are worthless this has got to be stopped even if we have to have more pump room Capacity - Rushing Lamps off the pump is a bad mistake -

I want ~~Joe to~~ you to alter over a dozen pumps or so & let Joe run off 50 Regular Lamps in his way

X-E62858

"Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, Orange, N.J.

and then select 4 20 from them &
also 20 from one of your Isles
& bring them to ~~Lamp~~ Laboratory
for a Curve = ~~Perhaps you~~
~~Oxidize the Carbons on the Machines~~

I dont think you want to dry the Lamps
any more or heat them we dont do it
here. The Machines prevent the moisture
from the breath to a greater Extent
than the old process

I think your 1st Volts should not Exceed
100 — & not 110 — The great thing
is to get the Water out of Carbons
before they reach a red heat,

E.

FRANCIS R. UPTON COLLECTION

1892

X-E6298
1892-10-05

American Institute of Electrical Engineers,

Ralph W. Pope,
Secretary
12 West 31st Street

New York Oct. 5, 1892.

Mr. F. R. Upton,

Harrison,

N.J.

My dear Sir:-

I enclose herewith bills for your examination and approval, which please forward to Dr. Herzog, 30 Broad St., as usual.

At the last meeting of Council I presented your letter in which you inquired of me as to your continuance on the Finance Committee. The Council was of the opinion that if you had no objection to serving, that they would be glad to have you continue on the Committee. Trusting this will be entirely satisfactory, I beg to remain,

Very truly yours,

Ralph W. Pope

Secretary.

Enclosures.

X-E628S-10
1892-10-18

SAMUEL INSULL, Vice-President.
THOMAS A. EDISON, President.
W. S. PERRY, Treasurer.
THOMAS BUTLER, Secretary.

NEW JERSEY AND PENNSYLVANIA CONCENTRATING WORKS.

GENERAL OFFICES:
EDISON BUILDING, BROAD STREET.
NEW YORK.

NEW YORK, Oct. 18th,1892.

F.R. Upton, Esq.,

c/o General Electric Company, Harrison, N.J.

Dear Sir:-

I have the pleasure to inform you that at a special meeting of the Board of Directors of this Company held at Edison, N.J. on the 15th inst., you were uanimously elected a Director in the place of Mr. Samuel Insull resigned. Kindly notify me of your acceptance in due course.

Yours very truly,

Thomas Butler

Secretary.

X-E6285-9
(1892)

REPORT OF COMMITTEE ON CLOSING OF LAMP DEPARTMENT AT LYNN.

It seemed best to run until the middle of next week, so as to finish up some of the work which was on the floor and which it would be very difficult to transport, and which could be run off in such shape that it could be transported with comparatively small expense.

The middle of next week an inventory should be taken of all active material and tools. The Committee recommends that only such material be shipped immediately as can be at once utilized at the Harrison factory either for the manufacture of lamps or for stock to be sold. This will avoid the expense of transportation and packing of material which may not be needed.

The following should be immediately sent to the Harrison factory:

All the glass blowing machines; inside part tools; latest instruments for treating carbons; all platinum and all mercury on hand; all standard bulbs and tubing; all standard rings and caps. The amount of lamps to be shipped will be fixed after the inventory, as well as the amount of work in progress.

The Committee also recommends that the man now engaged in experimenting on a new fibre should be kept at it for the present, as his work has shown good results and he is not a high priced man.

(Signed) F. R. Upton

(Signed) E. W. Rice

FRANCIS R. UPTON COLLECTION

1893

1893-03-30
X-E6285-10

ASSIGNEE'S SALE.- Notice is hereby given that I, the undersigned, as assignee of Jesse H. Lippincott, for the benefit of creditors, will sell at public auction, at the Real Estate Exchange and Auction Rooms, Limited, Nos. 59 to 65 Liberty street, in the City and County of New York, on April 11th, 1893, at 12.30 o'clock in the afternoon of that day, by Richard V. Harnett & Company, auctioneers, the following described personal property in my hands as such assignee, to wit: Forty-three (43) debenture bonds of the North American Phonograph Company, of one thousand ($1,000.) dollars each, at six (6) per cent. interest, payable semi-annually, Nos.258 to 300, both inclusive. Terms cash. Full particulars as to said bonds can be obtained at any time prior to the sale at the office of the undersigned.

Dated New York, March 30th, 1893.

Frederick S. Wait,

Assignee,

10 Wall street, N. Y.

Upton –

John C. Coleman,

Attorney for Assignee,

10 Wall street, N. Y.

I think these will go for a song & I believe they are worth par you might form a syndicate – & if you do nothing – see Perry & Cutting

E

X-E 62-98
1893-

1

UPTON'S AFFIDAVIT.

Affidavit of FRANCIS R. UPTON, to be used in the suit of *Edison Electric Light Company and Edison General Electric Company vs. Beacon Vacuum Pump and Electrical Company, Jacob Heilborn and Louis E. Whicher*, about to be brought in the United States Circuit Court 2
for the District of Massachusetts.

STATE OF NEW YORK, } ss.:
City and County of New York, }

FRANCIS R. UPTON, being duly sworn, deposes and says as follows:

I am forty years of age and reside at Orange, New Jersey. I am manager of the lamp-manufacturing department of the Edison General Electric Company, and have been manager of the Edison lamp factory for such 3
company and its predecessors since the establishment of the business in 1880. I have had occasion to make myself acquainted with the history and operations of the Beacon Vacuum Pump and Electrical Company. The following facts with regard to that company are stated on information and belief, except such facts as are stated as being within my personal knowledge:

The Beacon Vacuum Pump and Electrical Company was organized and incorporated in the year 1890, with a capital stock of $1,000,000, for the pur- 4
pose of developing a mechanical vacuum pump, which it was supposed by those organizing the company would be of great value in the manufacture of incandescent electric lamps, in which mercurial vacuum pumps were employed. They assumed that not only could the vacuum be produced much more quickly by means of their mechanical pump, and hence that a considerable saving in cost of manufacture would be effected, but also that the vacuum when produced would be one without the

5 presence of mercurial vapor, and that this would result
in a lamp which would have a greater length of life,
and in which the globe would not so readily blacken.
These advantages they assumed would be of so great
importance that they could lease their pumps to manu-
facturers of incandescent electric lamps and charge a
royalty on all lamps exhausted, which royalty was to
be about five cents per lamp. Such a royalty, if
received from all manufacturers in the United States,
on a basis of 10,000,000 lamps per year (which was
6 approximately the number manufactured in the year
1890), would amount to $500,000 per year. This,
as I understood it, and as I was informed and believe,
was the basis of the organization of the Beacon
Vacuum Pump and Electrical Company, with the large
capital stock of $1,000,000.

During the fall of the year 1890 and the following
winter, that company carried on negotiations with manu-
facturers of incandescent electric lamps, looking towards
the employment of its mechanical pump by those manu-
7 facturers. Among others approached upon this subject
was the Edison General Electric Company. A corre-
spondence on this subject was carried on between Mr.
L. E. Whicher, the treasurer of the Beacon Company,
and myself, as general manager of the lamp depart-
ment of the Edison General Electric Company. An
expert was set by me to Boston to examine the pumps
of the Beacon Company, and a number of lamps
made at the factory of the Edison General
Electric Company were sent to Boston and exhausted
8 by the Beacon Company and returned to our fac-
tory and there tested. We also offered to put
their pumps into our factory on trial, which
offer, however, was never accepted. I was also called
upon personally by Mr. Whicher, who came several
times to the Edison lamp factory to see me, and to
urge upon me the desirability of using the Beacon
mechanical pump for exhausting our lamps. In one
of these interviews he asked me to come to New York
and meet himself and another director of the Beacon
Company to discuss this same subject, which I did.

After a full investigation of the Beacon mechanical 9
pump, and complete tests of the lamps exhausted by
means of it, the experts of the Edison General Elec-
tric Company, including myself, came to the conclusion
that there was no advantage in the use of that pump
over the mercurial pumps which were then being used
by the Edison Company, and, as a result of that conclu-
sion, I refused to continue discussions with Mr.
Whicher, and the negotiations which he was attempt-
ing to forward ceased from that time. At the same
time that these negotiations were being carried on by 10
the Edison General Electric Company, the Beacon
Company was carrying on negotiations with other
manufacturers of incandescent electric lamps, and these
other manufacturers reached the same conclusion, as is
shown by the fact that none of them put the Beacon
pump into use in their factories.

In one of the later discussions between Mr. Whicher
and myself concerning the use of the Beacon pump by
the Edison General Electric Company, and when, as I
then understood, Mr. Whicher's negotiations with other 11
manufacturers of incandescent electric lamps were not
progressing favorably to him, Mr. Whicher said to me
in substance that if none of the manufacturers would
adopt the Beacon pump, the Beacon Company would
have to go into the lamp manufacturing business itself
in order to make its pump available. To this state-
ment I replied in substance that if the Beacon Com-
pany did go into the lamp manufacturing business it
would have to take the risk of infringing the Edison
filament patent, and of an early decision on that patent 12
by the courts. To this Mr. Whicher replied, in effect,
that he understood the situation of the litigation and
the risks which the Beacon Company would assume
in manufacturing lamps. This conversation took
place, to the best of my recollection, in the month
of November, 1890. At that time, as I then under-
stood, and as was a matter of common report in the
trade, the suit against The United States Electric
Lighting Company on the Edison filament patent No.
223,898 was being vigorously pressed, with the pros-

13 pect of an early hearing upon its merits, and the fact that there probably would be a decision in that suit within a few months was a matter of common discussion in the trade and of frequent comment in the trade journals. I find by an examination of the trade journals that the Beacon Company did not begin to advertise to sell incandescent lamps until May, 1891, and I am informed and believe that they did not begin to do any considerable amount of business in the manufacture and sale of incandescent electric lamps until the
14 summer of that same year after the decision of his Honor Judge WALLACE in the suit against The United States Electric Lighting Company on July 14, 1891.

In the fall of 1891 the Beacon Company became an active competitor with Edison General Electric Company in the business of manufacturing and selling incandescent electric lamps, and has continued to be so down to the present time. At the beginning of its business, the Beacon Company sold its lamps at fifty cents apiece. It subsequently reduced the price to
15 forty-five cents apiece, and in July, 1892, to thirty-eight cents apiece. Since the decision of the Circuit Court of Appeals for the Second Circuit in the suit against The United States Electric Lighting Company, on October 4th, 1892, it made a still further reduction in the price of its lamps, as is shown by a circular letter of that company, hereto annexed and marked "Upton's Exhibit A," and since that date it has made strenuous efforts by advertising a low price in the trade journals, by circulars and by personal solicitation to
16 dispose of its incandescent electric lamps. It has also, since said decision, attempted to increase its sales of incandescent electric lamps by circulars misrepresenting the effect of such decision and misleading users of such lamps as to their liability in continuing to infringe the said Edison Patent, and urging such users to continue to purchase infringing lamps. A copy of a circular of this character, dated November 16, 1892, is hereto attached and marked "Upton's Exhibit B."

From the facts I have stated, and from other facts which have been brought to my attention, I believe

that the Beacon Company has a large stock of infring- 17
ing lamps on hand, and is attempting to dispose of those lamps before it can be enjoined under the Edison Patent. These lamps will be widely distributed throughout the United States, where, in view of the fact that the life of an incandescent electric lamp under ordinary conditions of use is only about one year, they cannot be readily followed, and will probably in most cases be used up and destroyed before their location is ascertained; and, even in cases where the lamps are fol-
lowed, a large number of suits will be required against 18
vendees and users to enforce the complainants' rights under the Edison Patent.

Users of incandescent electric lamps, misled by the statements of the defendants and other infringing manufacturers not yet enjoined under the Edison Patent, and attracted by low prices, are also purchasing lamps in excess of their immediate requirements and carrying the same in stock. Several instances of this character have been brought to my attention. Enough lamps
could be obtained in this way to supply many users for 19
the entire remaining life of the Edison Patent. I am informed and believe that the defendant The Beacon Vacuum Pump and Electrical Company has on hand a stock of upwards of 50,000 lamps, and that, due to the increased business arising from the enjoining of other manufacturers, this company is at the present time running its factory night and day, and is producing about 4,000 lamps per day.

I believe that the immediate intervention of the Court
is necessary to prevent irreparable injury to the com- 20
plainants.

F. R. UPTON.

Subscribed and sworn to before me this day of , 1893.

EUGENE CONRAN,
Notary Public,
Kings and N. Y. Counties.

21

Upton's Exhibit A.

Jacob Heilborn, Prest. L. E. Whicher, Treas.

Beacon Vacuum Pump and Electrical Co., 22

Manufacturers of the

BEACON INCANDESCENT LAMPS.

Irvington Street.

Boston, Mass., Dec. 1st, 1892. 23

Reduced Price List.

Gentlemen—We desire to inform you that we will accept your orders for our lamps from this date at the following reduced prices:

16-candle power			$ 35	
25 " "			45	
32 " "			55	
50 " "			85	24
75 " "			1 35	
100 " "			2 00	
150 " "			3 00	
200 " "			3 75	
300 " "			5 00	
16 " "	anchored fila., R'way		40	

F. O. B., Boston. Terms, Net 30 days.

In order to make these reduced prices available,

25 orders must not be for less than 200 lamps, which may, however, be made up of various sizes if desired.

We make this reduction in our prices because our improved methods enable us to manufacture a first-class lamp cheaper than our competitors, and we desire that our customers shall get their share of this advantage.

Hoping to be favored with your orders, and assuring you of prompt shipment, we are,

Yours respectfully,
26 Beacon Vacuum Pump and Electrical Co.
H. S. Kaliske,
Bus. Mgr.

Dictated by H. S. K.

27

28

Upton's Exhibit B. 29

Jacob Heilborn, Prest.
L. E. Whicher, Treas.

Beacon Vacuum Pump and Electrical Co.,

Manufacturers of

BEACON INCANDESCENT LAMPS.

Irvington Street. 30

Boston, Nov. 16, 1892.

Gentlemen—In view of the recent Edison lamp decision, the General Electric Co. is endeavoring to secure long-time contracts from users of Incandescent Lamps, and, desiring that you should not be misinformed as to the true state of affairs, we take this means of notifying you that the said Edison patent expires Nov. 10, 1893, by limitation of the English 31 patent issued previous to the United States patent.

Royalty can be collected but once on the same goods; and if such has to be paid, we are fully able to discharge any obligation so incurred.

In order to fully protect you, should we be favored with a part of your trade during the ensuing year, we will, upon request, be pleased to furnish you with an indemnity bond, which will hold you harmless from any damages that may accrue to you by the use or sale of our lamps. 32

We hope to be favored with your future orders, assuring you that in addition to furnishing you a superior lamp at low prices, your orders will at all times receive our careful and considerate attention. We remain,

Yours very respectfully,
Beacon Vacuum Pump and Electrical Co.
(Signed) H. S. Kaliske,
Bus. Mgr.

Dictated by H. S. K.

FRANCIS R. UPTON COLLECTION

1894

[TO JOHN F. RANDOLPH]

Feb 26- 1894
X-E6285-8

Johnny
~~Johnny~~

Am I president of the Edison
E L Co of Europe Limited—
if so write Upton & say
~~that~~ I am clearing up my
affairs & want to resign
~~presidency~~ of the E E L Co of
Europe & say ~~that~~ he better
take it

[POSTMARK: APRIL 18, 1894]

4 05/1000 wanted

Everything Ok at Mine 6
Am pushing things
We load a 5.00 @ 80 lb
Chunk in 15 seconds -

X-E-6285-8
1894-04-18
(from envelope)

Upton -

You will notice Lamps are good in Candle power — We did not select the fils but sent them just as they Come that will account for the one broken in the oldest order = We will in practice select Them - We have made a second run & they are much better than the first - shapes good & everything Else - We run 10 000 at a time, Will send you next week about 15 orders & they with those you treat will give us all the data required, We shall be able to furnish you 150 000 a week & can double that amount if necessary say stock up with 2 million -

Edison

NEW JERSEY & PENNSYLVANIA
CONCENTRATING WORKS.
EDISON BUILDING, BROAD ST.,
NEW YORK.

WORKS: EDISON, SUSSEX CO., N. J.
ON HIGH BRIDGE BRANCH C. R. R. OF N. J.

EDISON
APR
18
1891
N. J.

X E-6285-8

Francis R Upton Esq

Orange

N Jersey

6091 L

X-E6298
1894-07-11

EDISON GENERAL ELECTRIC COMPANY
HARRISON, N. J.
LAMP MANUFACTURING DEPARTMENT.

July 11, 1894

Dear Mr. Edison:

We are not sending you any tests lately for the reason that last week our test room was closed on account of the closing of the factory and this week we are moving the room into new quarters. Tests in the future will be made with the alternating current.

I am very glad that your trouble proved to be so slight.

Yrs
Francis R. Upton

Upton - Cant you use Brown at factory until I get Ogden running he is paid by factory & might be utilized for couple of months E

X-E6285-10
(1894)

Pilling & Crane

Just had good ~~test~~ giving 65 barrells of which 49½ bbls. good Portland Cement ~~and~~ with only Eight inches of crushing surface, we corrugated it & rolls now take the ore all right, There will be no trouble to get the hundred bbls if you can wait if not you can come any time & see test with present conditions,

X-E6285-10

The test is much better than we expected with such a narrow roll— Eight inches being all we can spare ~~for~~ crushing The other part has to be smooth to get pressure—

Edison

X-E62-85-10
(1894)

Pilling & Crane -

A ~~test~~ made at five oclock gave 71½ bbls of which 56 ~~bbls~~ was Portland Cement size = our troubles are over

Edison

Cable Address "Edison, New York."

X-E6285-8
(1894)

From the Laboratory
of
Thomas A. Edison.
Orange, N.J. ______

Friend Coffin

I dont believe in the Buckeye Contract, in any point of view, Had they a good filament and were to sell out at cost & a reasonable profit it might be policy to buy but a secret process which produces Lamps infinitely worse than that by known processes cant be a very dangerous Competitor or valuable aquisition

Yours
Edison

FRANCIS R. UPTON COLLECTION

1914 - 1918

X-E6298
1914-12-14

Cable Address "Edison, New York"

From the Laboratory
of
Thomas A. Edison,
Orange, N.J.

December 14th, 1914.

Mr. F. R. Upton,
810 Union Bldg.,
Newark, N.J.

Dear Upton:-

Mr. Meadowcroft has shown me your telegram of sympathy in regard to the recent fire. I appreciate it and all of your kind words.

We are doing some tall hustling around here and I have about twelve hundred men working day and night cleaning up. These busy days and nights remind me of old times. I shall be back in the game in a short time.

Yours very ~~truly~~,

Thos A Edison

Speech made before first meeting of Edison Pioneers | I — ~~at~~ The Lawyers Club — New York City Feb. 11, 1918 — by F. R. Upton — 1st President of association

X-E 6285-13
1918-02-11

The greatest honor that has come into my life is the privilege of being the first President of Edison Pioneers.

The honor is doubly great in my eyes for the reason that the men who voted to make me President were entirely representative of the early days when I was connected with Mr. Edison and when we were all full of enthusiasm.

The pride of my life is that for several years I was able to be near such a leader of his race as is Mr. Edison.

My admiration of him is so great that sometimes I feel that it resembles the old Romans when they made Gods of their Emperors.

The dates given of Mr. Edison's work between the years 1870-1885 measure for most of us a lifetime of work as we look back from today.

To emphasize that we were pioneers, a few general statements of business and industry in 1870 compared with 1918 will remind us all that gray hairs mean passed and passing years.

Of all the 170 various industries mentioned in the 1870 census list, not one of them was electrical in any way.

That list of leading industries in the U.S.A. mentions only one establishment engaged in iron ship building and marine engines.

To show how we have grown, another item of interest is that there was in 1870 only 40,191 steam engines in the U.S. with a total horsepower of 1,130,000.

Today daily the several large power stations along the water front in Greater New York turn about the same horsepower into electricity. About one half of this total is sold under the name Edison and all of it is made ~~following~~ according to the Menlo Park experiments.

X-E6285-13
1918-02-11

~~These men were backing Mr. Edison to invent an electrical lighting system.~~

I joined Mr. Edison in Nov. 1878. At this time he had done some work in arc lighting and was going thoroughly through the art.

The first time I worked with him was down stairs in the old laboratory in the small room just back of the front door.

His intuition was then clearly marked, for his first line of calculations were on the general proposition if you double the resistance of the electric light you would need only one half the copper to feed the light. I still have a vivid memory of the efficiency and rapidity of Mr. Edison's mental processes and the need of being alert in any calculations. Fortunately for me, my mental pencils were sharp and my multiplication tables were near the surface. Still more fortunately for me mathematical calculations on electricity are apparently endless.

In 1879 the question was asked of me how much power an incandescent lamp took and the answer could only be conclusively given after finding out how long it took the lamp to heat a known weight of water a certain number of degrees. This method was not criticised when put before as competent men as Profs. Rowland and Brackett.

In this year 1918 if a small boy were asked how much power an incandescent lamp took, he would make an elementary sum of watts and candles and give the answer.

In 1879 these results ~~were~~ obtained by heating water were used to check up calculations reached by ~~using~~ employing Clark cells, standard Ohms and an electric dynamometer which Mr. Edison had made for me.

In this year 1918 I cannot imagine how I could not see the elementary facts in 1878 and 1879 more clearly than I did. I came to Mr. Edison a trained man. Post-graduate at Princeton; a year in Helmholz laboratory; with a working knowledge of calculus and with a mathematical turn of mind.

Yet I was blind in comparison with the eyes of today and as an apology I want to say that I had company.

in London where There was one monumental record in a lecture ~~the Philosophical Magazine~~ where a good friend of mine, now dead, said the division of the electrical current was commercially impossible. Another instance is where a man of very high intelligence said that the resistance outside of a dynamo should be equal to that in the armature.

I have recently gone over the article on Electricity by George Chrystal, M.A. Professor Mathematics, University Edinburgh, in the Encyclopedia Britannica, volume dated 1878. This article was one of the most useful in the literature of the day to Mr. Edison and his assistants. This article helps my apology for ignorance as there was no mention of a name for any unit for current.

X-E6285
1918-02-11

Ohms and volts are mentioned in this article, but with this qualification, "the determination of the British Association Committee is out by nearly 2 per cent."

In the index of the Encyclopedia this title is given "Unit, electromagnetic of current strength." Turning to this in the text one finds in the margin the words, "Unit of Current Strength." The following definition is given in the text:-

> "It follows, therefore, that the statement of our fundamental principle involves a unit of current strength such that unit length of the unit current, formed into an arc whose radius is the unit of length, exerts a unit of force on a unit pole placed in the centre of the arc. From this statement and the definition of a unit negative pole it follows at once that the dimension of the unit of current is ~~$(L^{\frac{1}{2}} M^{\frac{1}{2}} T^{-1})$~~" with the following formula

It is very evident in 1878 there were others who shared with me a lack of ~~clear~~ practically useful thinking regarding electric current.

In the article on Electrolysis by W. Napier Shaw, Emmanuel College, Cambridge, there is this statement "Moreover, if the current be varied by varying the number of battery cells, it will be found that the amount of decomposition in a given time is proportional to the current, that is, again, the quantity of electricity which traverses the substance."

It is very noticeable that there was no clear distinction drawn here between quantity and flow of electricity ~~in 1878~~.

To illustrate ~~this point~~ further, I quote from Prescott's book, published in ~~that year~~ 1878 where there is the following definition of a volt:

> "The volt is a little less than the electric motive force of a Daniell element, the latter being equal to 1.079 volts. For ordinary purposes, where great accuracy is not required, it is usual to consider the Daniell element as roughly equal to one volt."

I wonder whether the meter sharps today would consider an error of 8% sufficiently accurate for ordinary purposes.

3

X-E6285
1918-02-11

In this same book on electricity there is a definition of a unit of current which reads as follows:-

"The Veber $\frac{10^5}{10^7} = 10^{-2}$ or .01 absolute unit per second."

In applied science the most useful tools for the workers are widely accepted and clearly defined units of physical measurements.

These tools were largely lacking in 1878. The commercial knowledge of electricity was largely in the hands of electric telegraph workers. Mr. Edison had showed his leadership in that art when he invented the quadruplex.

When I first went with Mr. Edison, it was common to make comparisons of electro motive forces by stating that the tension was equal to so many batteries and to speak of resistance in the terms of so many miles of wire. The unit for measurements of electric current could be found only in the thoughts of comparatively few mathematicians.

The concept of electric current that distinguished between the flow and quantity of electricity was not provided with good words to express itself in.

At Menlo Park I worked hard to sharpen the definitions of electrical units and to fix reliable standards for physical measurements.

When I think over the history of incandescent electric lighting I have the satisfaction, which you all share with me, of having helped some in the progress of the world.

It was largely Mr. Edisons work to make real and distinct the conception of electricity as something which could be sold commercially. This conception is now so widely known as to seem almost self evident.

In talking with Mr. Bradley the other evening, I expressed

X-E6285
1918-02-11

to him the one great impression of my years in Menlo Park, how impenetrable the veil of the future seems to be when new problems are to be solved and how simple the result often is when the darkness of ignorance is lighted by the genius of man.

Mr. Bradley well phrased the genius of Mr. Edison when he said that invention and progress in the arts come through what he called "The Great Faith."

Mr. Edison in 1878 showed the Great Faith in holding to the high resistance lamp and low resistance armature. It took years of hard work to show results. Then when the veil of the future was parted, there could be seen the Edison system of Electric Lighting, one of the Worlds most magnificent inventive achievements.

When on a clear night I look out into the heavens and know that some of the light I see has taken hundreds, even thousands, of years to reach the earth; when I reason that time has had no beginning and will have no end; when I read that chemical reactions have been foretold; when I see that Life in plants and animals is so marvelous and yet so full of design; when I can imagine that this great war in which we all now are immersed may mean a great experiment in blending all the world together in a grand democracy; when I try to draw any conclusions from the great elementary fundamental facts, I am forced to believe that the God I worship is a Scientific, Loving God and I believe that the results I see around me have been worked out by patient trial and experiment.

With this as a belief I consider it no sacrilege to say that I think the genius of Edison is God-like in its infinite patience and industry.

To date Mch 1/1918 * indicates those present at first luncheon Rangers Club Feby 11/18

X-E-6285-13 118
1918-02-11

EDISON PIONEERS

Acheson, Dr. Edward G.	35 West 42nd St., New York City.
Andrews, W. S.	136 Park Ave., Schenectady, N. Y.
Brewster, Wm. F.	1827 Edison Bldg., Chicago, Ill.
*Brock, W. M.	Paterson, N. J.
Beggs, John I.	1428 First Natl. Bank Bldg., Milwaukee, Wis.
Burt, A. R.	General Electric Co., Schenectady, N. Y.
Benton, C. A.	103 Park Avenue, New York City.
*Beves, A. S.	New York City.
Bradley, C. S.	New York City.
Bush, A. R.	Schenectady, N. Y.
BYLLESBY H.M. LIEUT COL. SIG CORPS U.S.A	WASHINGTON, D.C. 2029 CONNECTICUT AVE
Casho, Joseph	1708 W. Allegheny Ave., Philadelphia, Pa.
Clarke, Chas. L.	General Electric Co., Schenectady, N.Y.
Callahan, Denis	Sprague Electric Works of General Elec. Company, Bloomfield, N. J.
*Campbell, H. A.	New York City.
*Donshea, William I.	55 Duane Street, New York City.
*Dyer, Philip S.	1 West 64th Street, New York City.
*Dwyer, John	General Electric Company, 120 Broadway, New York City.
DOUBLEDAY - H.M.	MONTEGO BAY, JAMAICA, B.W.I.
Edgar, Charles L.	70 State Street, Boston, Mass.
*Eidlitz, Charles L.	1170 Broadway, New York City.
*Estabrook, Charles E.	General Electric Company, 120 Broadway, New York City.
Francis, W. H.	Edison Company, 39 Boylston Street, Boston, Mass.
Francis, H. M.	71 Broadway, New York City.

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To date Mch 1 1918

* indicate those present at first Luncheon Lawyers Club Feby 11/18

EDISON PIONEERS (Cont.)

Grower, Geo. G.	Ansonia, Conn.
*Gilmore, W. E.	119 Prospect Street, East Orange, N.J.
*Howell, John W.	General Electric Co., Harrison, N. J.
*Howell, Wilson	Pleasantville, N. Y.
*Hammer, Edwin W.	160 Broadway, New York City.
*Hammer, Wm. J.	55 Liberty Street, New York City.
Hatzel, J. C.	89 West 119th Street, New York City.
Huey, Arthur S.	Room 1900 - 208 South La Salle Street, Chicago, Ill.
Hutchinson, J.	Electro Mechanical Laboratories, 1 Bishop Street., Montreal, P. Q.
*Hastings, F. S.	80 Broadway, New York City.
Insull, Samuel	72 West Adams Street, Chicago, Ill.
Jenks, W. J.	The Attleboro Sanitorium, Attleboro, Mass.
Jefferson, Charles W.	Schenectady, N. Y.
*Kiddle, Alfred W.	115 Broadway, New York City.
Knight, Arthur S.	309 Sears Building, Boston, Mass.
*Klein, Philip H.	23 Dowd Street, Montreal, Canada.
King, Charles G. Y.	Commonwealth Edison Company, 72 W. Adams Street, Chicago, Ill.
*Latimer, L. H.	160 Broadway, New York City.
*Lozier, Robert	New York City.
*Lieb, J. W.	124 East 15th Street, New York City.
Langton, John	New York City.
Lindsay, Robert	Cleveland Electric Illuminating Company, 619 Illuminating Bldg.,Cleveland, O.

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To date Mch 1, 1918

* indicates those present at first Luncheon, Lawyers Club, Feby 11/18

EDISON PIONEERS (Cont.)

Lighthipe, J. A.	Southern California Edison Company, Los Angeles, Cal.
Langton, John	233 Broadway, New York City.
*Mitchell, S. Z.	246 West End Avenue, New York City.
*Meadowcroft, Wm. H.	Orange, N. J.
*Martin, T. C.	New York City.
Moseman, Geo. H.	176 Federal Street, Boston, Mass.
*Mungle, Alex.	266 Canal Street, New York City.
*Moore, M. F.	Roselle, N. J.
*Moore, Alex. T.	New York City.
*Morrison, Geo. F.	General Electric Company, 120 Broadway, New York City.
*McClain, John F.	Vice-Pres. Remington Typewriter Company, 374 Broadway, New York City.
*Mott, S. D.	Passaic, N. J.
Nicholls, Frederic	Toronto, Canada.
*Ott, John F.	34 Ridgewood Ave., Glen Ridge, N. J.
Paine, S. B.	Boston, Mass.
*Philips, Eugene H.	11 Essex Avenue, Orange, N. J.
*Pelzer, William	343 East 68th St., New York City.
Price, Charles R.	New Bedford, Mass.
Porter, Joseph F.	Kansas City Street & power Company, Kansas City, Mo.

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To date
Mch 1 1918

* indicates those present at first Luncheon, Lawyers Club. Feby 11/18

EDISON PIONEERS (Cont.)

Rach, Christian	18 Fuller St., Schenectady, N. Y.
*Smithers, F. S.	525 Park Avenue, New York City.
*Stephenson, Henry	130 East 15th Street, New York City.
*Scheffler, F. A.	Glen Ridge, N. J.
*Shaw, P. B.	Pennsylvania Bldg., Philadelphia, Pa.
*Spencer, Thos.	1628 Alameda Ave., Lakewood, Cleveland, Ohio.
*Tate, Alfred A.	318 West 39th Street, New York City.
*Upton, F. R.	East Orange, N. J.
Weber, Peter	Newark, N. J.
*Wardlaw, Frank A.	New York City.
*Wurttz, Charles N.	Orange, N. J.
*Wilson, Fremont	154 Nassau Street, New York City.
Waddell, Montgomery	30 Church Street, New York City.
*Wirt, Charles	Armat & Lena, Germantown, Philadelphia, Pa.
Weeks, Edwin R.	604-7 New Nelson Building, Kansas City, Mo.
Wurth, Charles N.	177 High Street, Orange, N. J.
*Wheeler, Dr. S. S.	President Crocker-Wheeler Company, Ampere, N. J.

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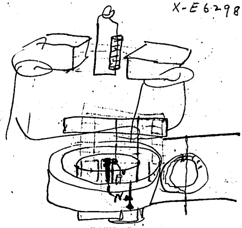
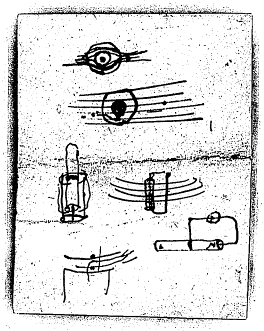
* 43

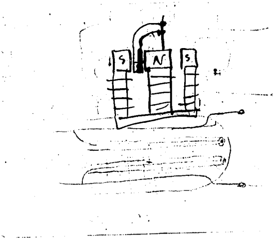
FRANCIS R. UPTON COLLECTION

UNDATED (CA. 1887-1894)

X-E 6298.



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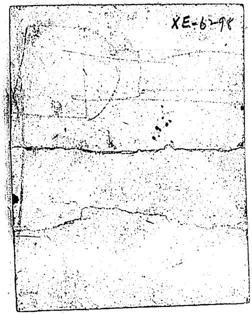

XE-6298

X-E6278

$8 $\frac{50}{}$ 224 days

horsepower costs $30 per year

cost $22 $\frac{40}{100}$

Lamps 8 50

Total $30 $\frac{90}{100}$

$8\frac{1}{2}$ per hp

2240. hours

of the 5.32. ~~Cost of~~ requ[illegible] to get same illumination.

1.6 hpower costing for 224 days $35 $\frac{65}{100}$ -

Lamps 35c

$36.00.

5.32 per hp

Life ~~35~~ 5000

Besides a bigger machine greater investment ~~of~~ greater Cost of hp costs more & new Eng & boiler [illegible] put in -

X-E6278

	64 -	2.40.
$16\frac{1}{2}$	48	11.20.
$13\frac{1}{2}$ per hp.	32	42.00.
~~8~~ hp. current	16	2240.00.
5.32 current ~~[illegible]~~	8. of 16.	40000.00.

– " 16 Candle Lights

X-E6298

	hours	min
$16\frac{1}{2}$ per hp in current	11	20
$13\frac{1}{2}$ " "	42	.00.
$8\frac{1}{2}$ " "	2240.	00.
$5.\frac{32}{100}$ " "	35000.	00.

X E 62-98

Partn		Minutes	hours h m
	64 Candles	165	2-45
	48 "	711	11.51
	32	2916	48.36
6	16	132 900	2215.
	8 Candles	2,126,400	35440.

165) 2556 (15.
165
906.
825
81.

47

15
52
150.

132900
16
797400
13290
2126400

60) 2126400 (35440.
180
326
300
264
240
240

Edison
Life of lamps.

X-E6278

96

5000-

I agree to go to work and
within six months at my
own Expense produce a
process and obtain the
Knowledge how to make
all the Lamps turned out
by the Lamp factory maintain
their Candle power 5 percent
better than any Lamp known
~~of~~ without impairing the
Economy or life of the Lamps-
which process shall not add
more than 2 mills per Lamp additional

Cost, if the Cost exceeds this
it is to come out of my
royalty - for this I want
a royalty of 8 mills per Lamp

X-E6285-8
(1890)

X-E6298

Nov 28 — (1887)

Upton —

Keep me posted How Lawson & Bradley getting along with new Carbonizing forms — Has L made any straight Carbons — if so has there any Lamps been made —

Edison

Lawson Has 608 of those forms I will Make the rest of the forms as soon as I Can Get the Carbon Mixture (2000 forms) Expect the Mixture Every day

B.

X-E 6298
(1887)

Upton — Send to Dixon Crucible Co and order 5 lbs fine Electrotypers Plumbago — ~~[illegible]~~
You might ask them If they make a quality more finely divided (ie) finer powder If so the price & get samples,

E

Its for the Clamp mixture —E

X-E6298
(1887)

Upton =

The records shew to date 17 fast to 10 Slow pump breakage - So I think there Can be now doubt that we Should use Slow pump

---

Regarding new Carbonizing The new method Shews much better than the old one So you have here a positive advantage = but wait a week & I will give you positive results -

Regarding method of working a whole line of pumps at once I have tried ~~& it's~~ it not good But I am going to try it again

E

P.S. Hickman is now making fils that knock your regulars silly - They are Extraordinary quickly work This you could use Finish pumps [illegible] Best Regds -

X-E62-98
(1887)

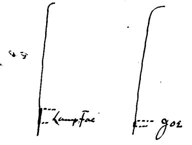
Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, ______ Orange, N.J. ______

Upton =

Your clamp material is put on too long



The extra air that comes off makes it difficult to get air out works slower on pump and oxidizes carbon while goe works quick & dont oxidize carbon —

Edison

OK = Please ask Force and [illegible] to run a month on the preliminary to 600 degrees for 6 hrs during the same time they run regular & when work required I send me some & the balance go in Regular

E

X-E62-85-8
(1894)

Cable Address "Edison, New York" From the Laboratory of Thomas A. Edison.

Subject: Orange, N.J.

Upton -

This leakage of seal serious 20% all Cont,

Its pbly due to bad platina also platina all marked up by some clamping tool perhaps glass not get hot enough or not enough pressure used - The ball made by fusing platina to Cap seems to me to be unnecessarily large

Edison

LABORATORY OF THOMAS A. EDISON, ORANGE, N. J.

X-E62-85-8

Francis R Upton Esqr
Orange
N Jersey

X-E6298

XE6298

Upton

Those 50 Volts La[illegible]
must be exhausted just as
if they were regular lamps
(1st) 16 & afterward connected
up for 50 Volts otherwise
The sides will be unequal —

Edison

XE6298

XE6298

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Orange, N.J.

X-E6285-8
(1894)

Upton

I sent a lot of fils to you the other day but none are on test all I want is that they be set up at say 240 c.p. hp so I can determine what we want, at the rate we are going about 6 years will be required in meantime I am getting short of money for Ogden

E

E-6285-105
(1889)?

Upton =

When do you think you will be able to take up the Loan ~~S~~Shall need every Cent I can raise to put Ogden through - its going to be a close shave but will be a whopping Success

Edison

X-E62858

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, ____________ Orange, N.J.

~~L~~

Old & new Styles

- ~~Westinghouse~~
- ~~Thompson Houston~~
- ~~Sawyer Man~~
- ~~United States~~
- ~~Perkins~~
- ~~Mather~~
- Sun
- ~~Brush Swan~~
- Western Electric Mfg Co — Wilmarth Chicago
- Fort Wayne Jenney —
- Van de pole Chicago
- Heissler
- Bernstein — Boston
- Vitrite aluminoid
- Schauffler

Anecdotage - at my mercy. X-E6298 (188)

First visit ~~[illegible]~~ 1877 telephone
Howard Russell Butler.

Then Telephone exchange 1878
Grosvenor P. Lowrey — Wall St imagination.
Edison as mathematician
First question doubling resistance
~~anecdote~~ Edison mind ~~sees~~ [illegible]
188[illegible] Paris - going with him
to find Horseless carriage

State of art 1878. E.M.F.
measured in terms of batteries.
Resistance in terms of mile of
wire. ~~No term~~ No special thought
of current as only very small
currents used in ~~[illegible]~~ telegraphic
work

Batchelor Kruesi

New nomenclature just coming in. Article in Encyclopedia Brittanica? on Electricity best authority of the time.

Weber? ~~~~ 10 point varied with?

Familiar history platinum to carbon

First pump for exhausting brought from Boiceton Brackett walked from Metuchen. Then all night trying it out. for first carbon lamp that burned and did not change

Winding armatures — Machine Shop

Big magnet

Low resistance armatures —

Preece — Weston —

Tests in water for power

Dynamometer

Clarke — Howell, Wilson — Hammer; Lawson; Segredor Moses —

Brackett Rowland Tests

~~Motors~~, ~~—~~ 3 wire — feeders — motors in multiple arc —

Central station plans –

Lamp making

Nursing – Carbonization

Vacuum, glass blowing

Boehm – Holzer – artistic temperaments –

Bases – Tom Howell

Fibres, World search –

~~Ot~~ Testing for life. –

~~It First work~~; First ~~at large~~ Hurry up then normal. Making lamp very hot on pumps – Financial worries –

Over 1,000,000 supported

E6285-11

Whately in his rhetoric speaks of a common fallacy, that time does anything ~~[illegible]~~ towards accomplishing results. He says that ~~of~~ the expression ~~[illegible]~~ give a certain subject time and results will follow, It is not the time but what is done in the passing moments ~~th.~~ which produces results. Few realize this and are puzzled to know how some men can accomplish so much in the course of a year. One of Mr. Edison's strongest traits is his ~~knowledge of~~ ability ~~[illegible]~~ to make the most of the moments. ~~When experimenting he is always in a great hurry~~ In experimenting his whole attention goes to gaining the point he is seeking after ~~at~~ no matter what cost, and he often will use ~~what~~ something that is ~~really~~ very valuable to ~~gain~~ perform some small service not caring whether it is spoiled or not. At no time does his ingenuity show itself more than in the ways he will make whatever object that lays under his hands perform service.

Methods of making instruments Tasimeter

Letting others do for him.

Saving of energy when one point is reached ~~at~~ cutting even the thought.

Concentration Seven years remembering

Power of drawing analogies. Reasoning from analogy

H_2O Mobile boer

~~Heat~~ Magnet Steam heaters

Sound light

Sanguine confident. yet always after a time doubting and wanting other ways of doing the same.

Method of reading & vital attention following one line of thought

Mathematical ability

seeming to know intuitively. Like Faraday, having clear notions of the nature of things and able to state his wishes in ~~p~~ a way which leads to the simpler equations. Example. If a ~~P~~ machine will run 5 light of an Ohm it will run one light of 25 ohms.

Ways of thought

Dropping one line for a time and going on another.

Suggestions acted on after some weeks. Beginning with crudities and after a moment or two clearly stateing the questions. ~~from~~ Seem as if he had no control ~~of~~ over his thoughts.

Trying a few experiments to keep his thoughts on a subject that he intends to investigate.

Wanting something new says others want ~~cri~~ &c. ~~&~~

E-6285-11

Never taking anything for granted always doubting what others think possible and thus leading to new ways.

Never in a rut since never satisfied. First question when anything works well how to make an other.

Wanting a fact to start with and then building up from that

Varying an experiment in every way so as to determine.

Starting with an idea of what he wants to make the experiment a success. Ex. Carbon telephone his search directed towards finding a substance that would act as carbon.

Fertility in mechanical device. Say that he can imitate any motion of the fingers by means of machinery. Stock printers

When on an experiment working all day and all night until the trouble is found out so that his workmen may be put to work on it.

No trying a crucial experiment to settle a difficulty but making hypotheses to account for the fact and the trying experiments on them. Learning to seek for opportunities to make odd trials.

Use of telegraphic instruments

ability to ask original questions. I notice that I can answer questions very easily after they are asked but find great trouble in framing any to answer.

Enormous power of concentration

Rapidity of experimenting. Seeing the trouble in a machine very quickly

Dexterity with hands. Power of reproducing images.

[CA. 1903-1910?]

Cable Address "Edison, New York."

From the Laboratory of Thomas A. Edison.

Subject, ______________ Orange, N.J.

E6285-10

Inventor — Remarkable for ~~[illegible]~~ ~~[illegible]~~ his energy in the application of Science to Industry — His greatest success was the invention of the Incandescent light system, among other inventions is the Transmitter of the Telephone, Moving pictures, Quadruplex Telegraph Phonograph and more recently a ~~storage battery~~ permanent Storage Battery of very light weight ~~[illegible]~~ ~~[illegible]~~ for vehicle traction,

now is the winter of our discontent made glorious summer by this son of york and all the clouds that lowred upon —

The boast of heraldry of pomp and power all that beauty all that wealth ere gave alike await

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END

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Thomas A. Edison Papers

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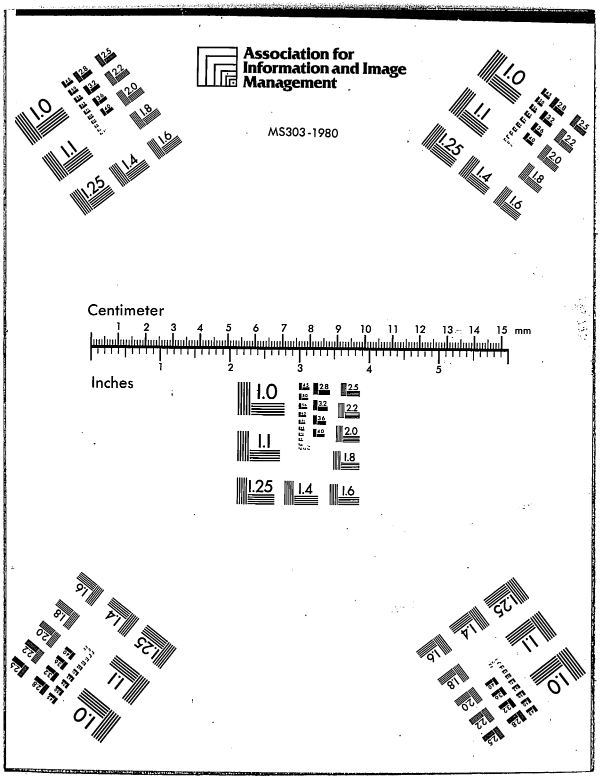
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